SECOND NATIONAL ENERGY EFFICIENCY ACTION PLAN FOR ARMENIA

ARMENIA RENEWABLE RESOURCES AND ENERGY EFFICIENCY FUND

FIRST DRAFT

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ECONOLER

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ABBREVIATIONS

BAU	Business as Usual
BEP	Building Energy Performance
BU	Bottom Up
CDM	Clean Development Mechanism
CHP	Combined Heat and Power
CoM	Covenant of Mayors
E5P	Eastern European Energy Efficiency and Environment Partnership
EBRD	European Bank for Reconstruction and Development
ECU	Eurasian Customs Union
EE	Energy Efficiency
EEAP	Energy Efficiency Action Plan
EED	Energy Efficiency Directive
EMS	Energy Management System
EPBD	Energy Performance in Buildings Directive
ESCO	Energy Services Company
ESD	Energy Services Directive
EU	European Union
GEF	Global Environmental Facility
GGF	Green for Growth Fund
GWh	Gigawatt hour
GHP	Geothermal Heat Pumps
IFI	International Financial Institutions
ITS	Inogate Technical Secretariat
KfW	(Kreditanstalt für Wiederaufbau) German Development Bank
Ktoe	Kilotons of oil equivalent
kWh	kilowatt hour
LEDS	Low Emissions Development Strategies
LFI	local financial institution
MWh	Megawatt hour
MoENR	Ministry of Energy and Natural Resources
MUD	Ministry of Urban Development
MoE	Ministry of Economy
MoT	Ministry of Communication and Transport
NBU	National Bottom-Up
N/D	No data
NEEAP	National Energy Efficiency Action Plan
NGO	Non-Governmental Organization
NSSD	National Strategy for Sustainable Development
RES	Renewable Energy Sources
SEAP	Sustainable Energy Action Plan

SWH	Solar Water Heater collectors
TD	Top-Down
Toe	tons of oil equivalent
TPP	Thermal Power Plant
UNDP	United Nations Development Program
USAID	United State Agency for International Development
WB	World Bank

EXECUTIVE SUMMARY

Energy efficiency policy has a pivotal role to play in Armenia's economy: It is essential for creating conditions for economic growth while improving energy security. By reducing the energy intensity of the national economic output, energy efficiency holds the key to maintaining a safe, sustainable and affordable energy supply, while meeting increasing energy demand and improving quality of life for the Armenian population. Under conditions of extreme import dependence for fossil fuels, energy that Armenia's citizens, businesses, and infrastructure *do not use* is the cheapest, cleanest, and most secure energy resource.

The potential for energy efficiency in all sectors has been assessed repeatedly and remains high, despite the relatively low energy intensity of the economy. The Armenian Government has taken legal action to promote efficiency through various programs and policies, but the potential for efficiency improvement still remains largely untapped. With energy prices rising, the urgency of accelerating the uptake of energy efficiency throughout Armenia's economy has increased. The goal of the second National Energy Efficiency Action Plan (NEEAP) is to assess the effectiveness of ongoing efforts by the Government, donors, international financial institutions and the private sector to improve the efficiency of energy use since 2010, when Armenia's first NEEAP was developed. The second NEEAP also identifies barriers to more extensive efforts in this direction, proposes measures to help overcome these barriers, and offers additional energy efficiency improvement measures for the period covering 2015–2020. The key pillars of the second NEEAP are:

- Reducing energy demand by improving the efficiency of energy end use;
- Improving national energy security by reducing the need for imported energy resources;
- Decreasing the energy content of the key economic outputs to reduce costs and raise the competitiveness of output;
- Addressing growing energy affordability concerns through energy efficiency solutions (instead of relying on social aid); and
- Providing impetus for behavioral change by decoupling growth from energy use, and thus enhancing the quality and sustainability of development through the introduction of knowledge and traditions for resource efficiency and smart growth.

The development and adoption of the Second NEEAP for the Republic of Armenia is one of the steps on the pathway upon which the Government of Armenia embarked a decade ago, by adopting Armenia's first Law on Energy Saving and Renewable Energy. The Republic of Armenia developed its first NEEAP in 2010 to accelerate the implementation of its national energy efficiency policy. The first NEEAP set forth a set of programmatic and policy measures for energy efficiency improvement for all economic sectors of the country. The first NEEAP, adopted by Government Resolution #43 on 4 November 2010, set the country on track for a ten-year process with intermediate targets and interim evaluations. Because adequate data

were not available at the time for developing targets based on statistics, the first NEEAP provided rough estimates of the potential impact of the proposed measures as fractions of the overall target up to 2020.

The 2010 energy balance was prepared shortly after the completion of the first NEEAP. The indicative target for the end of the first NEEAP was thus later quantified by the team developing the second NEEAP using the energy balance data for 2010.[1] Since the second NEEAP was prepared in 2015, the first period was assumed to cover 2011-2014. The energy saving target for the first period of the first NEEAP was baseline energy consumption of 2010 (1900.6 ktoe). The second NEEAP sets an interim target of 3.3%, equivalent to 63.3 ktoe. The assessment of the first NEEAP revealed that this target has been outperformed: The overall energy saving reached by 2014 was 6.3% (120.3 ktoe).

The second NEEAP continues the relevant measures from the first NEEAP, and in addition proposes an updated bundle of measures and energy saving targets for the second period, covering 2015-2017. The second NEEAP tracks both the indicative milestone year 2018, as well as a long-term plan until 2020. The document was prepared based on the template recommended by the Energy Community, in which the Republic of Armenia has had observer status since 01.10.2011.

In accordance with the NEEAP methodology, the baseline used in the second NEEAP is the average energy consumption from three consecutive years (2010, 2011 and 2012), in this case 2,047 ktoe. Based on the assessed progress under the first NEEAP and the expected impact of the ongoing and new energy efficiency improvement measures, the second NEEAP proposes a new set of targets for 2017 (9.9% instead of the 10.4% proposed in the first NEEAP),

[1] EC-LEDS Program In Armenia.

for 2018 (11.2% instead of 13.8%), and a higher overall target for 2020 (34.2% instead of 22.3%).

Table 0. 1. National Indicative Targets under the Second NEEAP

National indicative target in 2020 (ktoe)			422.2		
National indicative target in 2018 (ktoe)			282.0		
National intermediate target in 2017 (ktoe)			212.6		
National intermediate indicative target in 2014 (ktoe)			120.3		
	Sector target In 2014 (ktoe)		Revised estimated energy saving target		
			(ktoe)		
Sector division of target	Target	Achieved	2017	2018	2020
Horizontal and CC	-	35.5	40.6	43.1	48.2
Residential	18.8	0.1	31.3	34.1	51.4
Services	3.5	0.0	4.9	5.3	6.1
Industry	24.0	13.9	34.6	47.5	483.5
Transport	15.5	70.6	90.4	96.7	109.5
Agriculture	1.5	0.1	1.7	1.7	1.7
Total:	63.3	120.3	203.5	228.3	700.3
Percentage (%)(compared to reference consumption)	3.3%	6.3%	**9.9%**	11.2%	**34.2%**

It is noteworthy that some of the ongoing energy efficiency programs in Armenia, particularly those financed by international financial institutions and the banking sector, have been assessed in depth for past performance, but were reluctant to provide any projections of future

lending due to market volatility. For this reason, the reduced targets of the second NEEAP may be outperformed when energy efficiency financing is quantified in the third NEEAP.

Table 0. 2. Overview of targets and achieved/projected energy savings both in respect of primary and final energy

	Final energy saving target		***Primary Energy Saving Target***	
	in absolute terms (toe)	*Percentage (%)(compared to reference final consumption)*	*in absolute terms (toe)*	*Percentage (%) (compared to reference primary energy consumption)*
2014(interim period)	*115.4*	*6.1%*	*4.9*	*0.16%*
2017(interim period)	*192.3*	*1.1%*	*11.2*	*0.04%*
2018 (overall period)	*215.0*	*1.2%*	*13.3*	*0.05%*
2020 (extended period)	*278.6*	*1.6%*	*421.7*	*1.46%*

Table 0. 3. Overview of targets and achieved/projected energy savings in respect TO BOTH final AND primary energy

	Final energy saving target		*Primary Energy Saving Target*	
	in absolute terms (toe)	*Percentage (%)(compared to reference final consumption)*	*in absolute terms (toe)*	*Percentage (%) (compared to reference primary energy consumption)*
2014 (interim period)	*115.4*	*6.1%*	*4.9*	*0.16%*
2017 (interim period)	*192.3*	*1.1%*	*11.2*	*0.04%*
2018 (overall period)	*215.0*	*1.2%*	*13.3*	*0.05%*
2020 (extended period)	*278.6*	*1.6%*	*421.7*	*1.46%*

The second NEEAP introduces new measures for all sectors. The broad range of measures includes enforcing new regulations, integrating energy efficiency into public procurement, encouraging improved energy performance of industrial and small and medium enterprise (SME) energy consumers, and introducing a comprehensive monitoring and planning approach for the transport sector.

In addition, the measures include promoting end-use distributed generation of renewable electricity and thermal energy by energy end-users. This—primarily includes the increased use of solar energy for hot water preparation and the application of heat pumps and increased use of solar photovoltaic technology via net metering. These proposed measures are based on and

closely related to existing strategic documents, action plans and programs to promote renewable energy.

The national intermediate indicative targets for 2017 and onward were calculated on the basis of the average final consumption of energy during the realization of first NEEAP.

Table 0. 4. National indicative targets for 2017

Indicative target in 2017 (ktoe)	**10%**	
Realized savings in 2014 (ktoe)	6%	
Sector	Sector target	
	2017 (ktoe)	%
Horizontal	40.6	4.17%
Residential	31.3	1.84%
Public sector	4.9	9.55%
Industry	34.6	17.67%
Transport	90.4	1.13%
Agriculture	1.7	9.94%
Total:	**80.06**	100.00%

A significant number of strategic documents and regulations related to the implementation of energy efficiency measures have been adopted in the Republic of Armenia. The impacts of these individual actions are difficult to evaluate separately due to their synergistic natures and overlapping results -- particularly in the case of horizontal and cross-sectoral measures. For this reason, a combination of top-down and bottom-up methodologies was used to estimate the achieved (2014) and potential (through 2020) energy saving impacts of these programs (see Table 0.4).

Table 0. 5. Tons of CO2 emission avoided by target year based on Sectoral Measures

Sectors	Tons of CO2 emission avoided by target year			
	2014	**2017**	**2018**	2020
Horizontal and CC	183,156.88	209,514.79	222,693.74	249,051.65
Buildings (Residential)	1,366.26	28,860.00	28,860.00	28,860.00
Public Buildings and Services	186.32	25,493.02	27,292.80	31,249.79
Industry	158.36	270.13	1,211.54	2,261.54
Transport	31.37	40.15	42.93	48.63
Agriculture	-	7,636.80	15,318.00	22,954.80
Total GHG Avoided (tons CO2)	183,532.93	271,814.88	295,419.02	334,426.40

In order to achieve these estimated savings through implementation of the energy efficiency measures proposed in the second NEEAP, it is necessary to strengthen Armenia's institutional framework, especially related to buildings. Several steps forward have already been taken in this regard: For example, the newly adopted Housing Legislation stipulates that every multi-apartment facility must operate as a legal entity, requiring residents to form a community of building tenants or delegate the housing maintenance function to a professional organization. This legislation, combined with the enforcement of the amended Law on Energy Saving and Renewable Energy and the related secondary legislation, will enable faster renovation of multi-apartment buildings. In addition, the increased establishment of Home-Owners Associations will ensure a higher quality of housing maintenance and, potentially, increased efforts at thermal modernization of buildings. This is an expected outcome of the establishment of private maintenance companies and the enhanced development of energy services companies (ESCOs).

The Ministry of Energy and Natural Resources (MoENR) is responsible for monitoring the implementation of the second NEEAP and reporting results based on measurement and verification of energy savings. As a first step, the MoENR will need to establish an information system for tracking all energy efficiency activities and assessing the energy savings; this will help avoid measurement and verification problems stemming from the current lack of data (apparent during the preparation of this NEEAP) needed to calculate the savings from individual measures. This task may be assigned (outsourced), if necessary, to expert teams outside MoENR.

The implementation of the second NEEAP will also require identification of stable funding sources to support the measures that depend on extra-budgetary sources of financing; a

number of measures outlined in the second NEEAP still do not have committed funding. A small part of the budgetary resources (Central and Local) are still available to be allocated for the drafting of the policies, development of tariff reform, and preparation of programs within the specific measures; however, significant additional funding necessary for the implementation of the energy efficiency investments will be required from donors and IFIs.
Table 0.5 summarizes all of the energy efficiency measures in the sectors of final energy consumption that are outlined in the proposed second NEEAP, as well as the assigned responsibilities for implementation and the estimated funds required.

A more precise assessment of necessary financial resources, as well as proposed sources of financing, will be elaborated in the programs and plans for the implementation of specific energy efficiency measures identified in this NEEAP.

Table 0. 6. Summary of energy efficiency measures in the sectors of final energy consumption

No	Title of the energy saving measure	Expected Energy Saving (MWh)		Required financing (US $)
		2017	2018	
I.3.a.	Financing for Energy Efficiency: GGF	35,069	35,069	15,354,000
I.3.b.	Financing for EE: IFC EE loans for households and SMEs	35,792	35,792	40,000,000
I.3.c.	Financing for EE: for residential and business clients, EBRD ArmSEFF	341,655	341,655	28,000,000
I.3.d.	Financing for EE: East.Eur. EE and Environment Partnership (E5P)	n/a	n/a	22,470,000
I.6.	Removing inadequate gas tariff structure to encourage energy savings	59,365	89,047	n/a
I.7	Support to Armenian municipalities in SEAP Implementation	22811.0	31961.0	11,000,000
II.7	Improving Energy Efficiency in Buildings (UNDP/GEF BEEI project).	1,200	1,200	1,200,000
II.9.a.	Financing for EE in Housing: Jerm Ojakh (NMC/AFD)	141	164	13,000,000
II.9.b.	Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	4,914	5,067	3,629,507
II.9.c.	Financing for Energy Efficiency: KfW Housing EE credit line	TBD	TBD	22,898,000
II.10	Mitigating Tariff Increase with Low-income Energy Efficiency Program	116,159	116,159	9,092,687
II.11	EE Retrofits in existing residential buildings: National Program and Action Plan for MAB Renovation & EE	65,000	65,000	25,000,000
II.12	Appliance Energy Labeling Awareness Campaign	176,704	209,369	5,000,000
III.1.	Public Building EE: Implementation of energy saving activities in municipal and social public facilities (R2E2/GEF/WB)	521	521	10,700,000
III.2.	NAMA project to Support EE in Public Buildings and Social Housing	11,442	14,653	24,000,000
III.3.	Green Urban Lighting Project GHG , UNDP	47	47	452,670
III.4.	Financing for Energy Efficiency & Public Procurement for EE: EE-integrated reinforcement of Schools by KfW	39,897	39,897	15,000,000
III.5.	EBRD Loan-funded Yerevan street-lighting	1,277	1,277	6,000,000
III.6.	USAID Clean Energy and Water Program for EE & RE solutions in community energy and water use	19	19	76,237
IV.1	Considering energy efficiency aspects during approval and construction of n ew industrial facilities	271968.7775	397131.5729	3,000,000
IV.2	Increasing the efficiency of the central heating plants and suppliers: Avan DH - cogeneration	67,327	70,693	12,000,000
IV.3	Implementation of EE Financing Facility for Industrial Enterprises	Tracked as part of cross-cutting		
IV.4	Natural gas savings through improvement of transmission pipelines and subs tations, and optimisation of existing boiler houses inTPPs	-	-	515,000,000
IV.5.a	Reduction of energy losses in distribution networks: WB Electricity Supply reliability	-	-	41,550,000
IV.5.b	Reduction of energy losses in distribution networks: EBRD Power Supply Reliability	-	3,311	70,000,000
IV.5c.	Electricity savings through improvements of existing electricity network, com pensation of reactive power and improvement of transformers	-	18,000	25,000,000
IV.5.d.	Reduction of Electricity Losses in Low-voltage networks, ArmElNet	62,072	62,072	22,768,434
IV.6	Wider Application of Renewable Energy: SWHs	10	12	-
IV.6.b	Geothermal Heat Pumps for Central Heating	705	705	68,251
IV7	Distributed RE generation: PV promotion through net metering	608	2,729	66,000,000

V.1	Development of legislative background regarding fuel efficiency and emission norms of vehicles	-	-	2,066,200,000
V.2	Dissemination of information on technologies and approaches for reducing energy consumption effectively	-	-	-
V.3	Continuous exchange of mini buses by larger passenger buses	1,045,391	1,118,245	34,200,000
V.4	Expansion and modernisation of the electrified public transport: City of Yerevan	5,294	5,294	37,000,000
		n/a	n/a	-
V.5	Expansion and modernisation of rail transport network	862	972	Mixed
V.6	Continuous switching of road vehicles from gasoline to compressed natural gas (CNG)	n/a	n/a	PS, uncontrolled
V.7	Development of Integrated Electro-Transport Network and services to cover unmet demand for public transport in Yerevan agglomeration	-	-	TBD
VI.1	Rural development program: EE agricultural machinery import	9.4	9.4	
VI.2	Importing high efficiency tractors, Japanese ODA	5	5	N/D
VI.3	Irrigation system enhancement project, WB	1,267	1,267	33,100,000
VI.4	Irrigation rehabilitation emergency project, WB	73	73	36,220,000
VI.7	USAID Clean Energy & Water Program	150	150	265,803
VI.10	Irrigation System Modernization and Institutional Capacity Building, WB	19,000	19,000	44,000,000
VI.13	Energy efficiency for greenhouse industry	425	480	-
VI.15	Grading agricultural products based on quality	8,620	25,900	N/D
VI.16	Renewing the agricultural machinery park	134	201	N/D
VI.18	Install gravity irrigation	17,200	34,500	-
Grant Total		2,366,267	2,655,651	3,372,465,588
		39,674	52,918	KTOE

The successfull achievement of the envisaged measures entails the full commitment of all participants in this process. The second NEEAP was prepared using the following control list of measures necessary for effective realization:

- Continued reform and eventually amendment of the Law on Energy Saving and Renewable Energy and associated bylaws on energy auditing and energy efficiency in public procurement
- Continued operation of the Renewable Resources and Energy Efficiency Fund
- Smooth integration of Eastern Europe Energy Efficiency and Environment Partnership (E5P) funds to leverage lending with grant co-financing
- Development of new/improved housing legislation
- Building codes enforcement
- Tariff reform
- Incentives for wider combined energy efficiency-integrated renewable energy application
- Improvement of energy efficiency data collection and periodic energy balance calculation

- Low-income assistance for implementation of energy efficiency measures
- Development and provision of technical assistance in best available energy efficiency technologies for the industrial and agricultural sectors (e.g., greenhouses and aquaculture)
- Strengthening the institutional capacity of the State to develop and implement energy efficiency policy..

One of the highest priorities is to urgently develop an efficient information system for monitoring and verification of activities and energy savings associated with the implementation of energy efficiency measures. The success of the proposed measures largely depends on systematic and timely oversight of implementation of the measures set out in this NEEAP. Table 0. 7. Summary of first NEEAP Targets, Achievements, and Revised Second NEEAP Targets at a glance.

Table 0. 7. Summary of first NEEAP Targets, Achievements, and Revised Second NEEAP Targets

Sector/Measure		Baseline Final Energy Consumption	Estimated annual savings SECTOR TARGET based on 2010 baseline (% and ktoe)		Sector target in 2014 (ktoe)	Baseline Final Energy Consump-tion	Estimated annual savings per measure based on 2010-2012 average baseline (% and ktoe)				Aggregated savings target by 2020	
		2010 (in ktoe)	annual/ cumulated savings	Cummulative 1st NEEAP TARGET set for 2014 (in ktoe)	ACHIE-VED	Avg for 2010-2012 (in ktoe)	Cummulative for 2017 (1st NEEAP)	Cummulative for 2017 (2nd NEEAP revised)	Cummulative for 2018 (1st NEEAP)	Cummulative for 2018 (2nd NEEAP revised)	in ktoe (1st NEEAP)	Cummulative for 2020 (2nd NEEAP revised)
I.	Horizontal Measures (Cross-cutting investments in AG.IND, RES)	no target	NO TARGET									
			Cummulative ktoe		35.5			40.6		43.1		48.2
II.	Building Sector (Residential)	695.7	Cummulative %	2.7%	0.0%	750.5	9.9%	4%	13.5%	4.5%	23.0%	7%
			Cummulative ktoe	18.8	0.1		74.3	31.3	101.3	34.1	172.6	51.4
III.	Public & Private S ervice Sector	206.9	Cummulative %	1.7%	0.02%	267.9	6.1%	1.8%	8.4%	2.0%	14.6%	2%
			Cummulative ktoe	3.5	0.04		16.3	4.9	22.5	5.3	39.1	6.1
IV.	Industry Sector	358.3	Cummulative %	6.7%	0.0%	362.1	19.8%	10%	26.2%	13%	23.3%	134%
			Cummulative ktoe	24.0	13.9		71.7	34.6	94.9	47.5	84.4	483.5
V.	Transport Sector	499.6	Cummulative %	3.1%	14.1%	520.7	9.0%	18%	11.4%	19%	20.3%	22%
			Cummulative ktoe	15.5	70.6		46.9	90.4	59.4	96.7	105.7	109.5
VI.	Agricultural Sect or/ Forestry	140.1	Cummulative %	1.1%	0.09%	145.7	2.3%	1.13%	2.7%	1.1%	14.0%	1%
			Cummulative ktoe	1.5	0.13		3.4	1.7	3.9	1.7	20.4	1.7
VII.	Total	1900.6	Cummulative %	**3.3%**	**6.3%**	**2047.0**	**10.4%**	10%	**13.8%**	11.2%	22.3%	34.2%
			Cummulative ktoe	**63.3**	**120.3**		**212.6**	203.5	**282.0**	228.3	422.2	700.3

INTRODUCTION

The Armenian Government has taken ambitious steps to reform the energy sector, improve the economic efficiency of energy use and promote the greter use of renewables. Several policy documents, such as the Energy Sector Development Strategy, the Law on Energy Saving and Renewable Energy, the National Program on Energy Saving and Renewables, the first National Energy Efficiency Action Plan and the Energy Security Concept have all clearly voiced the priotity that the Government of Armenia attributes to development of renewable energy, energy efficiency and energy saving programs, diversification by primary energy sources and supply routes, regional integration, as well as development of nuclear energy.

The Republic of Armenia has developed its first National Energy Efficiency Action Plan (NEEAP) in 2010 for the period 2010 – 2014 as part of the overall attempts to accelerate the implementation of the national energy efficiency policy. The first NEEAP set forth a set of programmatic and policy measures for energy efficiency improvement for all relevant economic sectors in the country. According to the European best practices, development of NEEAP is a regular process and targets at a ten-year period. The first NEEAP was developed without adequate statistical basis, but provided rough estimates of the potential impact of the proposed bundle of measures as fractions of the overall target up to 2020 (adopted by Goevrnment Resolution #43 from 4 November 2010.

The present document is the second NEEAP in this series and provides the Government of Armenia with an assessment of progress against these targets during the period of 2010-2012 using the estimated baseline energy consumption for 2010. Due to the experienced delay in the preparation of the second NEEAP, the first NEEAP assessment goes beyond the reported timeframe for the first period and tracks programs and measures implemented up to 2014, inclusive. The second EEAP uses the 1st NEEAP assessment conducted by the R2E2 for horizontal/cross-cutting measures, newly conducted assessment of implemented sectoral programs as foundation to, where necessary, revise the current measures and establish a new sectoral measures in order to ensure the achievement of objectives by year 2017, 2018 and 2020. Then the second NEEAP continues the relevant measures from the first NEEAP, as well as proposes an updated bundle of measures and energy saving targets for the second period covering 2015-2017, tracking both the indicative milestone year 2018, as well as a long-term plan until 2020. The document was prepared based on the template recommended by the Energy Community which the Republic of Armenia holds an observer status since 01.10.2011.

The NEEAP provides a framework for the development of measures to enhance energy efficiency improvement, with a stronger focus on the energy end-use, and platform to evaluate the energy savingsresulting from the implementation of these measures in the long run. The method and specific features of the assessment of the total and intermediate indicative targets are described in this document.Aggregate and individual data on energy consumption have been used to set the targets

based on the 2010-2012 energy balance data.[2] Where possible, total primary sources and final energy consuption was roughly assessed beyond 2012 to allow for adequate assessment of the impact of the first NEEAP measures.

The updates in the second NEEAP are largely aimed at documenting a diverse package of measures that have been undertaken by various players in all sectors of the economy, new initiatives that have been introduced after the first NEEAP was developed, as well as refreshing the data on timing for implementation of energy efficiency (EE) improvement measures in the light of growing energy prices and emerging energy supply sufficiency concerns. The legal ground for preparation of EEAP is determined in the Government Decree adopting the 1st NEEAP.The second EEAP for the period 2015-2017, considering targeted energy efficiency savings by 2018 and 2020, prescribes the energy savings objectives and prescribes measures and activities for achieving intermediate energy savings target for 2017.
The 2nd NEEAP will provide a framework for the development of measures to enhance energy efficiency improvement, in particular for end-use energy consumers, and platform to evaluate the energy savings resulting from the implementation of these measures.

[2] Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) Program in Armenia. Available at http://energybalancearmenia.am/

1 OVERALL CONTEXT OF THE SECOND NEEAP

The Armenian Government has developed and adopted several major national policies, strategies and programs, secondary legislations and regulatory frameworks as well as international treaties related to the implementation of energy efficiency policies. The chart below lists the acting policies, programs, regulations and treaties governing the scope of NEEAP implementation.

Figure 1. Energy Efficiency Policies, Strategies and Regulations

The review of the above policy framework is attached to the Second NEEAP with consideration of accomplished energy savings as well as expected savings from continued policy efforts in market transformation in the consequent chapters, as well as further reform recommendations.

The desk study revealed the gaps in the policies, including:

- The lack of financial incentives for energy efficiency to support the enforcement of the voluntary provisions of the Law on Energy Saving and Renewable Energy
- The lack of enforcement in the existing energy efficiency regulations, including enforcement procedures for the latest Government decree on mandatory compliance with EE requirements in state investment projects and residential construction

- A number of legislative initiatives have been put forward (technical regulations on building safety and energy performance, amendments to the Law on Urban Development, draft amendments to the Law on Energy Saving and Renewable Energy, draft regulation on appliance labeling), which are still pending adoption or on hold. Their status as well as impact on national energy saving targets must be reassessed to conclude on recommended further steps in these reform directions. Furthermore, the present legal initiatives, particularly those related to appliance labeling, must be revisited to adjust the provisions of the earlier draft regulation on appliance labeling targeted at EU Labeling directive transposition to comply with the EEU.

- Many donor- and IFI-funded initiatives have already tested a number of a successful and promising technical and financial solutions for promotion of energy efficiency in various sectors of the economy. These have also provided solid empirical evidences on the expected impact of particular energy efficiency measures, as well as potential barriers which can hamper the successful implementation of specific energy efficiency measures.

The second NEEAP seeks to propose scaling these up to national efforts. Similarly, the assessment of the first NEEAP and the work on thesecond NEEAP revealed limited attention to other types of EE Investments, hence the second NEEAP seeks to propose a new set of EE improvement measures and programs addressing the market barriers and utilizing the untapped energy saving potential in other sectors.

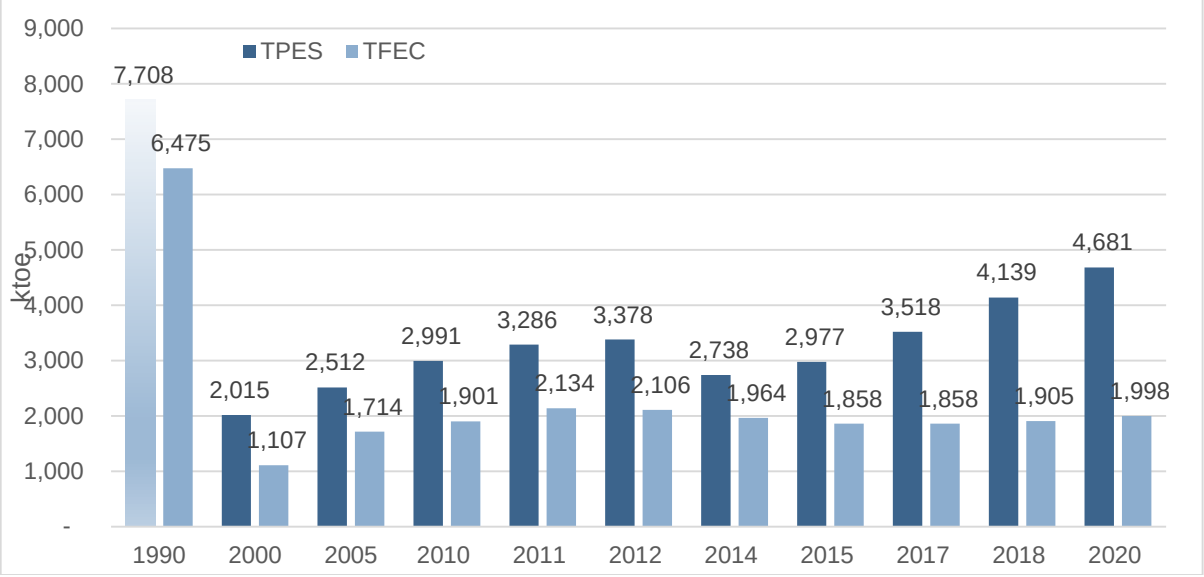
1.1 Highlights of the Second NEEAP

The second NEEAP assesses the progress made in the directions outlined by the first NEEAP. The intention was to use the average energy demand for 2008-2010 as the reference, but since the energy balance was only calculated for 2010 and further two years, 2010 was the only reference for a baseline. But since the first NEEAP, the 2010, 2011 and 2012 energy balances were prepared, and the following target yeras (2017, 2018 and 2020) use the average of these three consecutive years as a reference baseline for the consequent energy saving targets.

1.2 National context of energy savings

Armenia's energy consumption currently represents only a small fraction of the level prior to collapse of the Soviet Union.

Figure 2. Total primary and final energy sources used in Armenia since 1990, statistics and forecast.



Since independence, Armenia has struggled to recover the level of economic output and the economy has grown at a steady rate, and so did the energy use. The restructuring of the economy with more focus on services and away from heavy industry has helped reduce the energy intensity of economic growth and decouple energy from growth which is a major step towards a sustainable energy pathway and green economy (See **Error! Reference source ot found.**).

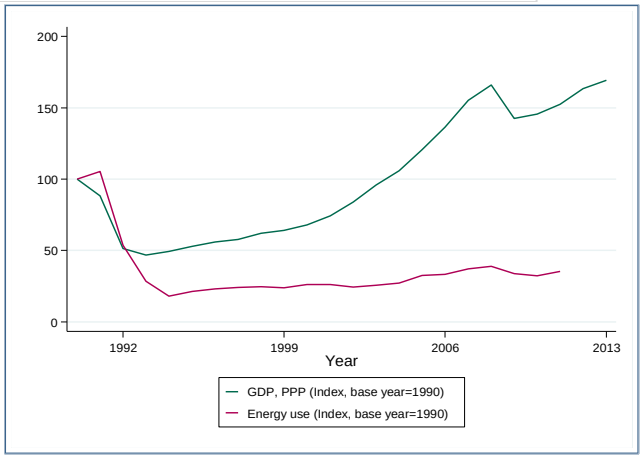
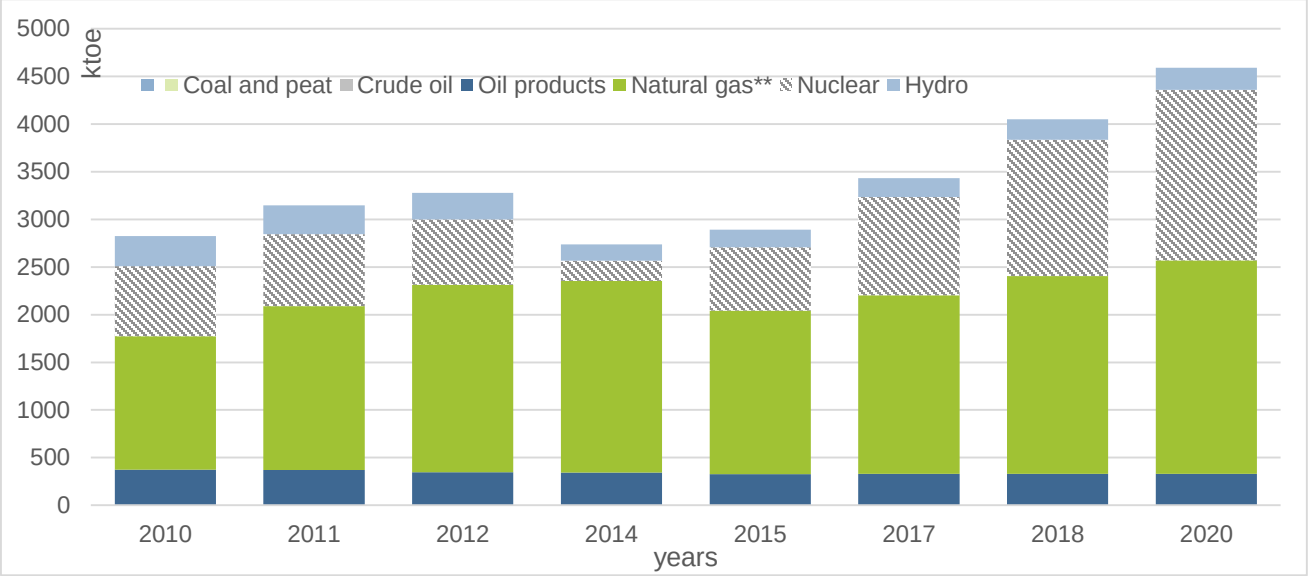


Figure 3. Economic Growth and Energy Use in Armenia. WB 2014

Nevertheless, final energy consumption has increased in recent decade. The residential sector was the the largest consumer, responsible for

over one third of total final energy, followed by the transport sector with a share of 25% in 2012. Nevertheless, both sectors make only insignificant contributions to GDP. Industry used only 18% of energy, which is far beyond the industry's share in the soviet era. Commercial and public services accounted for about 16% and agriculture - for about 7%. The share of the residential sector fluctuates depending on weather conditions. Only the commercial and the public service sector showed steady increase of energy consumption over the last years.

Figure 4. Final energy consumption in Armenia by sector (in ktoe)*



Source: USAID, 2012. Reference scenario for 2015-2030.
**Data for 2000 and 2005 are from IEA, Statistics*
Source: Annual Report of the Ministry of Energy and Natural Resources of RA

Currently available projections[3] are based on 2006 data and assume an increase of the share of industry in overall final energy consumption until 2030, as well as a slight increase of the share of transport. The share of all other sectors was expected to decrease. Practice seems to develop differently. The *Long-Term Strategic Development Program of the Armenian Government 2014-2025* plans an annual economic growth of up to 6-7% and a doubling of GDP by 2025. Highly qualified jobs ensuring high labour productivity is considered as the main directions. The Program, in fact, may become a straightforward strategy for a country poor in natural resources. The envisaged work places indeed may be less energy-intensive. Therefore, in a reference scenario, one would expect an increase in energy consumption in commercial and public services.

After the deep fuel crisis in 1992 when consumers had only 2-4 hours of electricity per day and most households depended on firewood or electricity for heating (World Bank, 2011), the electricity system

[3]Although the projections are not compatible with current development and need to be adjusted there was no other projection to rely on. Say explicitly that a new study is needed here.

has been restored. Electricity generation in Armenia relies mainly on natural gas (54% of total installed capacity) followed by hydropower (22% of installed capacity). The nuclear power plant built in the Soviet period is still in operation and contributes 19% of total installed capacity.

Table 1. Electricity consumption by major customers (unit: MWh)

	2005		2010		2011		2012		2013	
	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%
Industry	1,020	24	1,047	23	1,083	22	1,180	23	1,209	23
Transport	113	3	119	3	120	2	127	2	124	2
Residential	1,498	36	1,611	36	1,808	37	1,902	37	1,950	38
Commercial and public services	197	5	207	5	233	5	227	4	228	4
Agriculture/forestry	421	10	263	6	226	5	226	4	130	3
Other non-specified	930	22	1,260	28	1,400	29	1,458	28	1,526	30
Total:	4,180	100	4,508	100	4,870	100	5,120	100	5,167	100
Source: Annual Report of the Ministry of Energy and Natural Resources of RA										

More than half of facilities producing 4.4 GW of total installed capacity of operating power plants are older than 40 years, and thus are at the end of their lifecycle; moreover many units operate far below

their installed capacity.[4] They need replacement or substantial investment into refurbishment to extend their life span. The same is true for the electricity grid which requires comprehensive rehabilitation.

Efforts on modernization of power plants had been undertaken and two new modern gas-fired thermal power generation capacities were constructed (the Yerevan CCGT Unit with an installed capacity of 271.7 MW commissioned in 2010 and the Hrazdan Unit N5 with an installed capacity of 480 MW commissioned in 2011).

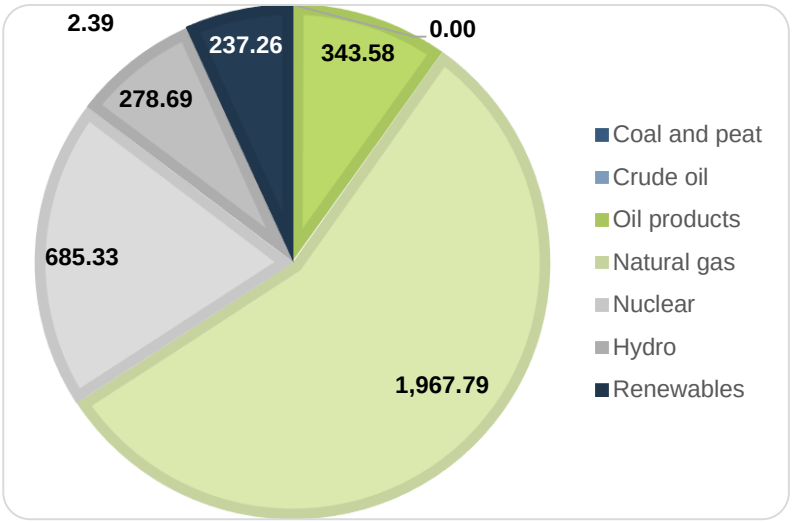


Figure 5. Total Primary Energy Sources by Fuel, 2012

A steadily growing electricity demand (see Figure 6) and the necessary shut-down of under-maintained infrastructure, including about 1,300 operable power generation facilities, have resulted in the need for new power-generating capacities to be constructed in order to meet an envisaged supply gap in 2017 (World Bank, 2011). The operable capacity of the current Nuclear Power Plant (NPP) cannot be increased and hydro energy is dependent on weather conditions. Discharges from the Sevan Lake to the Sevan-Hrazdan cascade are limited and strongly depend on the irrigation regime. The working capacity of the Vorotan cascade power plants is also limited due to the water flow in in the river. Therefore the load of Vorotan cascade is highest during the spring-summer months and lowest during the autumn-winter months. The assessment of the gap has shown different results ranging from 800 to1,100 MW of new, operable generation capacity in order to meet peak load and to maintain a 25% reserve margin (World Bank, 2011)[5]. Substantial export capacities will remain. 75% of the capacity of the new Yerevan CCGT and of unit 5 at Hrazdan TPP, as well as full capacity of the Meghri HPP (to be operational in 2019) are dedicated to electricity export.The

[4] At Hrazdan TPP 800 MW are operable out of 1050 MW installed, and at Yerevan TPP only less than 10% of installed capacity. Efficiency is very low (370g of fuel per kWh)compared to new gas fired blocks at Hrazdan (260-270 g/kWh) and to the new Yerevan CCGT (170g/kWh). (World Bank, 2011)

[5]The IMF assumed a 4% annual GDP growth rate during 2011-2030. (World Bank, 2011, 11)

current and forecasted structure of electricity generation is presented in Figure 6 below.

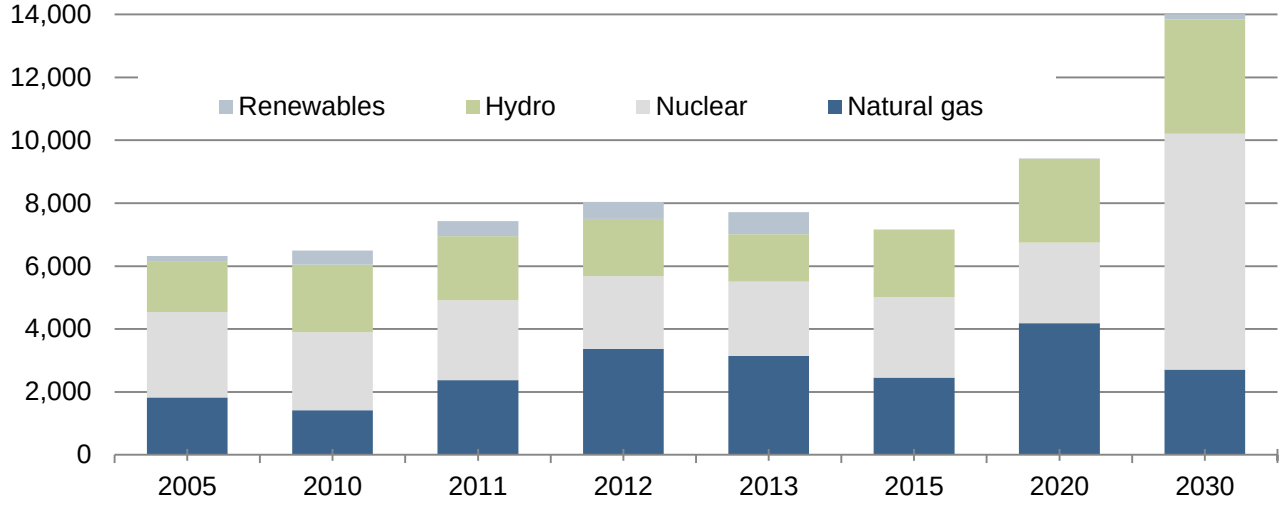


Figure 6 Electricity generation by fuel (in GWh)

Aside from electricity generation, natural gas is consumed in all other sectors. Gasification reached 96% of the country, being competitive against electricity prices, despite the continuously growing prices. The dynamics of gas prices is presented in the Chapter 4.1.

Table 2. Natural Gas Consumption Structure

million m3	2010	2011	2012	2013	2014
Imported Natural Gas	-	2069.1	2455.5	2361.05	2450.9
Supplied through distribution network, of which	-	1534.92	1608.9	1821.92	2008.8
Population	-	550.75	542	538.93	515.4
Energy	-	184.91	231.9	252.29	594.1
Industry	-	252.04	259.9	275.261	252.1
Pressurized Gas filling stattions	-	362.36	418	454.96	481.7
Public Sector	-	51.45	48.4	49.89	49.1
Other Consumers	-	133.42	108.7	250	116.3
Average Calorifi Value (kCal/m3)					8214

The energy consumption is still strongly correlated with greenhouse gas emissions, nonetheless some decoupling trend has been observed due to introduction of more renewables into the energy mix, particularly the small hydro power capacities.

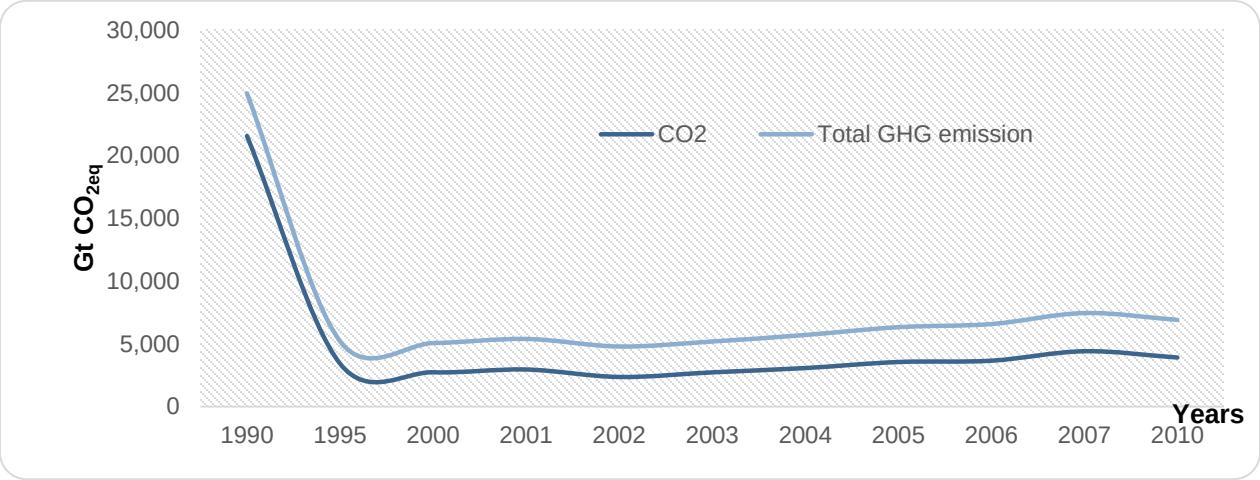


Figure 7. GHG Emissions in Armenia until 2010 (in Gt CO_{2eq} excluding LULUCF)

Source: RoA 3rd National Communication to UNFCCC

As an indicator of efficiency of energy use studies usually compare energy intensity of GDP. But another illustrative indicator is the per capita energy use. For both indicators Armenia remains one of the lowest the lowest if compared with counties in the region, the Energy Commnunity and the EU Member States.

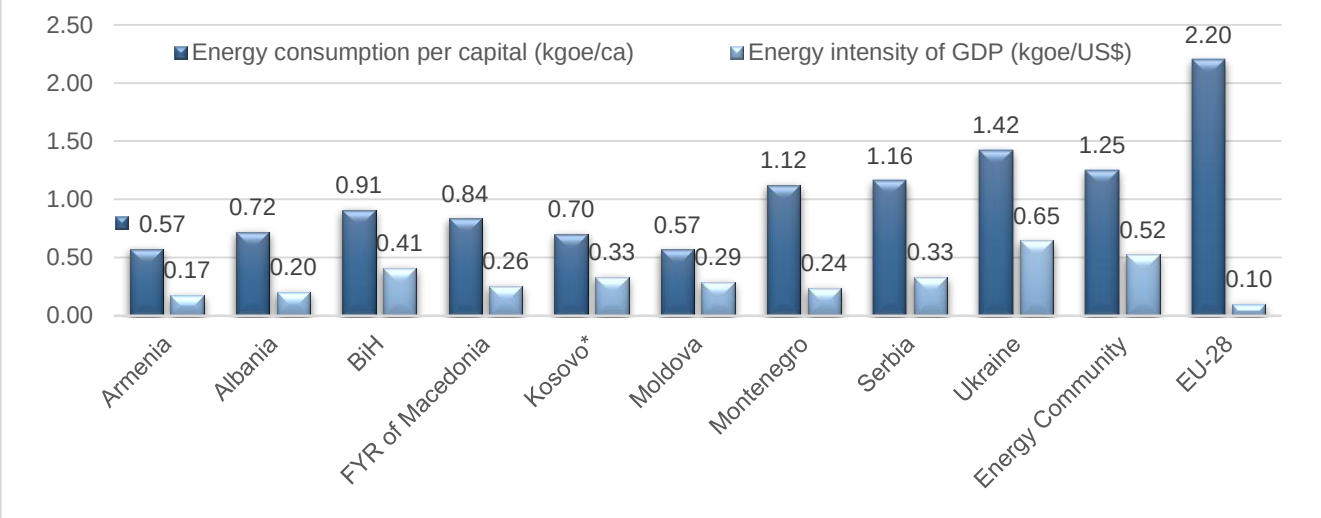


Figure 8. Comparison of Energy Consumption per Capita and Energy Intensity by Countries

Armenia's first National Energy Efficiency Action Plan (NEEAP) was developed in 2010 when there was no detailed energy balance in the country and the latest bottom-up data collection was conducted in 2005 for the development of the National Program on Energy Saving and Renewable Energy, adopted in 2007. The lack of statistical data limited the possibility of assessing the energy saving potential adequately, as well as quantifying the indicative energy saving targets.

1.3 Setting the Target

As a best-practice strategy for NEEAPs, the baseline is selected based on the average of the three consecutive years for which adequate statistics were available. Given the availability of detailed energy balance for 2010-2012 in Armenia, the present NEEAP uses the average of these three years to set the baseline.

This NEEAP also uses the energy intensity of GDP, sectoral energy intensities, as well as primary or final energy use per capita. Similarly, the targets set by the Government for national programs and strategies aimed at energy efficiency usually use primary or final energy sources used by a target year. The NEEAP is no exception. Energy efficiency targets for the NEEAPs can be set based on:

- primary or final energy consumption;
- primary or final energy savings;
- energy intensity.

Considering that the energy system losses are estimated by various studies at approximately 30%, and that the second NEEAP also focuses on supply-side energy efficiency measures, which will also deliver substantial primary energy saving. A TPES target will be better for Armenia's economy with consideration of the resource efficiency, economic competitiveness and energy security considerations. As recommended by the European best practices, and for the ease of use and monitoring, Armenia's second NEEAP also expresses those targets in terms of an absolute level of primary energy consumption and final energy consumption in 2020 and shall explain how, and on the basis of which data, this must be calculated.

The comparison of total primary energy consumption in the CIS countries—among them Armenia and Georgia acting as observers to the EnC Treaty and Ukraine and Moldova acting as contracting parties—shows that TPES consumption in Armenia is the second lowest in the region (See). As noted above, this does not necessarily act as an indicator of efficiency, but rather shows a lack of technological advancement and economic development, as well as heavy reliance on service sectors. These factors allowed Armenia's GDP to grow faster than its energy consumption.

The below table presents the total primary energy sources and final energy consumption for the three latest years for which adequate statistics was available and their average as the baseline for the second NEEAP energy saving target.

Table 3. Total Primary and Final Energy Sources (ktoe) in 2010-2012

	2010	**2011**	**2012**	**Baseline (3-year average)**
Total Primary Energy Sources (ktoe)	**2,991**	**3,286**	**3,378**	3,218
Final energy consumption (ktoe)	**1,901**	**2,134**	**2,106**	2,047
Source: USAID "Enhancing Capacity for Low Emission Development Startegies (EC-LEDS) Program in Armenia" Implemented by Tetra Tech,Preliminary Results of National Energy Balance Calculation for Armenia for 2010-2012				

An absolute energy consumption limit for a country is adequate if it needs to meet a certain quantitative target (e.g. need to cut national energy use by 20% to cope with the deficit in Ukraine in 1990, or the EU countries bound by the 20-20-20 target of the Union[6]). Since Armenia is not expected to contribute to any absolute target, cost-effectiveness and alignment with national economic development objectives are the applicable decision criteria, and the size of the target is based on the remaining cost-effective energy savings potential and its ability to pay for the necessary investments, i.e., their current GDP and its future changes.

Hence, Armenia's target is decoupled from any absolute quantitative target and a linkage is proposed to the enforcement and effectiveness of national policies, energy efficiency financing, promotion of energy services and the provision of information. Such a target is tied to quality of growth, reducing the energy content of the output without geopardizing the economic development of the country. As the graph below indicates, Armenia has already made some progress in this direction in the past decade.

[6] Bertoldi, P., EU 2020 and 2030 Energy Saving Targets and the role of National Energy Efficiency Actions Plans, Presentation, ACEEE, 2014

Figure 9. Energy Intensity (TPES/GDP) in CIS countries, 1990-2012

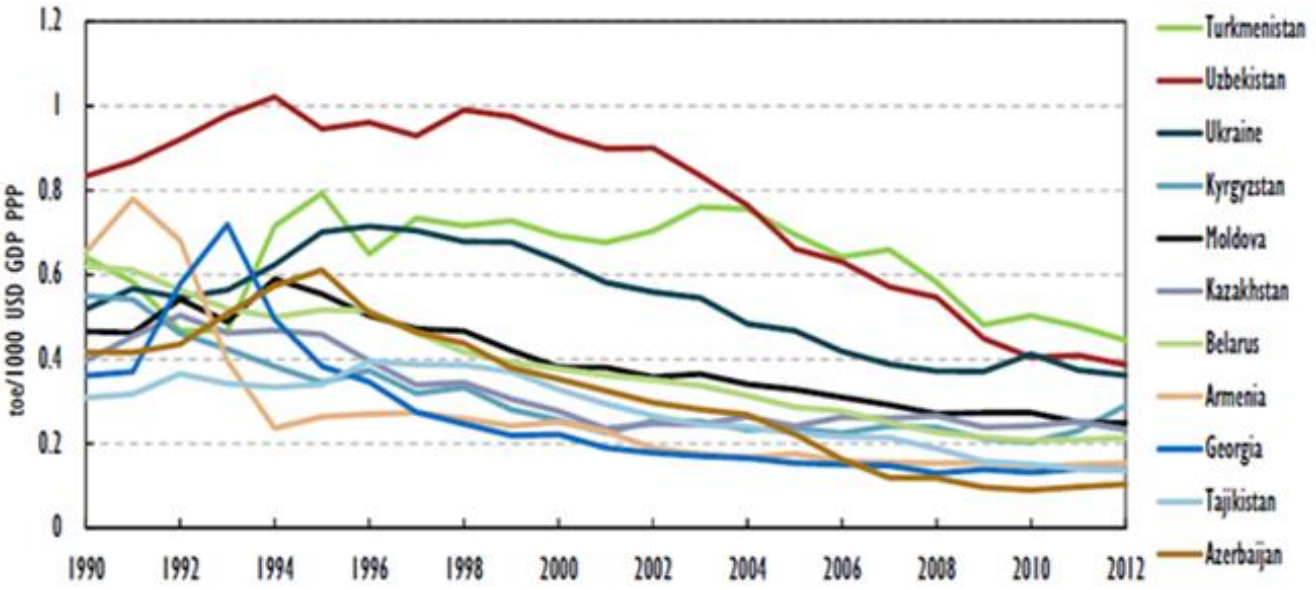


Figure 10. Energy Intensities of the CIS Countries[7]

Table 4. Energy intensity indicators for different sectors of energy consumption

	2010			2011			2012		
	Energy use in sector (ktoe)	Sectoral GDP (AMD bln)	Energy Intensity (ktoe/ bln AMD)	Energy use in sector (ktoe)	Sectoral GDP (AMD bln)	Energy Intensity (ktoe/bln AMD)	Energy use in sector (ktoe)	Sectoral GDP (AMD bln)	Energy Intensity (ktoe/bl n AMD)
Industry	358.27	824.40	0.43	356.43	999.00	0.36	371.72	1,121.90	0.33
Transport	499.62			523.76			538.83	639.27	0.84
Agriculture	140.15	636.70	0.22	141.94	795.00	0.18	155.11	841.50	0.18

Since the building sector is very mixed in purpose of use and is not universally contributing to creation of value towards the national economy, the usual energy intensity of GDP does not adequately characterize the building sector. Energy consumption per capita and/or per heated space area are the common indicators used to charachterize the energy performance of the building sector.

Table 5. Energy and Population Dynamics, 2010-2012

Population	**2010**	**2011**	**2012**	**Average**
Total area of housing stock, ths. km²	88,633.5	92,597.7	93,411.8	
*population *1000*	3,262.6	3,021.4	3,026.9	
Electricity consumed by population	138,548.2	155,460.4	163,508.2	
Natural gas consumed by population	442,492.4	452,386.1	445,198.8	
TOE per capita	0.58	0.70	0.57	0.58

Based on the analysis of the above indicators and sector-specific opportunities, the second NEEAP of the Republic of Armenia has assessed the energy saving impact of a range of ongoing, planned or proposed activities. This assessment allowed measuring progress against first NEEAP targets as well as revise those targets to match the new developments.

[7] van der Hoeven, M., Energy Policies Beyond IEA Countries: Eastern Europe, Caucasus and Central Asia, IEA, 2015 publication launch, 13.04.2015

Table 6. Summary Overview of firts NEEAP Targets and Accomplishments, Revised Targets for second NEEAP

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
	Horizontal & Cross Cutting							
I.3.a.	Financing for Energy Efficiency: GGF	EE and RE solutions for households space heat and lighting efficiency (windows, doors,heat supply, lighting, distribution systems) and SMEs	Start: 2014 End:: 2020 (ongoing)	35,069	35,069	35,069	35,069	partially implemented
I.3.b.	Financing for Energy Efficiency: IFC EE loans for households and SMEs	residential energy end-use, SME EE of production processes, space heat conservation	Start:2009 End: 2015	35,792	35,792	35,792	35,792	partially implemented
I.3.c.	Financing for Energy Efficiency: Energy efficiency loans for residential and business clients, EBRD ArmSEFF	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)	Start:2006 End: 2015	341,655	341,655	341,655	341,655	partially implemented
I.3.d.	Financing for Energy Efficiency: Eastern European Energy Efficiency and Environment Partnership (E5P)	faclitation of energy efficiency finance in municipal infrasturcture with grant co-financing	Start: 2015 End: ongoing	n/a	n/a	n/a	n/a	initializing, tracked as part of other measures
I.6.	Removing inadequate gas tariff structur e to encourage energy savings	Developing a revised tariff structure which would not penalize SMEs and autonomous heating systems	Start: 2016, ongoing	-	59,365	89,047	148,412	not implemented
I.7	Support to Armenian Municipalities in Sustainable Energy Action Planning	municipal infrastructures, building sector, households	Start: 2015; End 2020	3056.4	22811.0	31961.0	51082.8	new measure
Sectoral Subtotal			MWh	412,516	471,880	501,562	560,927	
Sectoral Subtotal			KTOE	35	41	43	48	

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
Buildings/Residential								
II.7	UNDP/GEF Improvement of Energy Efficiency in Buildings Project	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2013; End: 2017	1,200	1,200	1,200	1,200	partially implemented
II.9.a.	Financing for Energy Efficiency: Household energy efficiency loans and EE mortgage loans (NMC/AFD)	Household EE loans and EE mortgage loans ; residential buildings and private homes' space heating, hot water preparation	Start:2014 End: 2020	136	141	164	211	partially implemented
II.9.b.	Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	residential energy end-use in space heating and hot-water preparation	Start: 2013; End: 2018	30	4,914	5,067	5,067	partially implemented
II.9.c.	Financing for Energy Efficiency: KfW Housing EE credit line	Residential energy end use, heating, hot water preparation, lighting	Start:2016 End: 2020		TBD	TBD	TBD	pending
II.10	Mitigating Tariff Increase with Low-income Energy Efficiency Program	Residential energy end use, lighting efficiency	Start: 2015; End: 2016	new measure	116,159	116,159	116,159	new measure
II.11	EE Retrofits in existing residential buildings: National Program and Action Plan for MAB Renovation & EE	Existing residential buildings, space heating	Start: 2016; End: 2020	new measure	65,000	65,000	65,000	new measure
II.12	Appliance Energy Labeling Awareness Campaign	Residential energy end use, lighting efficiency	Start: 2015 End: 2020	new measure	176,704	209,369	409,635	new measure
			MWh	1,366	364,118	396,959	597,272	
			KTOE	0	31	34	51	

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
Public Buildings and Services								
III.1.	Public Building EE: Implementation of energy saving activities in municipal and social public facilities (R2E2/GEF/WB)	Implement EE in public facilities to reduce the level of energy consumption by social and other public facilities under energy saving agreement (ESA) scheme with ESCO participation.	Start: 2012 End: 2017	401	521	521	521	partially completed
III.2.	NAMA project to Support Energy Efficinecy in Public Buildings and Social Housing	New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2016 End: 2020 (ongoing)	new measure	11,442	14,653	21,037	partially completed
III.3.	Financing for EE & Public Procurement for EE: UNDP Green Urban Lighting Project GHG Emission reduction by increasing energy efficiency of municipal lighting in the cities of Armenia	Municipal lighting electricity use in the cities of Armenia	Start:2013 End: 2017	new measure	47	47	47	partially completed
III.4.	Financing for Energy Efficiency & Public Procurement for EE: EE-integrated reinforcement of Schools by KfW	Public & service buildings (schools)	Start:2016; End: 2020	none, new measure	39,897	39,897	39,897	pending
III.5.	EBRD Loan-funded Yerevan streetlighting	Municipal lighting electricity use in 49 streets of Yerevan, Armenia	Start: 2015; End 2017	new measure	1,277	1,277	1,277	pending launch
III.6.	USAID Clean Energy and Water Program for EE & RE solutions in community energy and water use	rural communities, agricultural water users, community organizations, municipalities	Start: 2012	19	19	19	19	completed
			Total MWH	420	57,417	61,470	70,382	
			Total TOE	36	4,937	5,285	6,052	

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
Industrial Processes and Power Sector								
IV.1	Considering energy efficinecy aspects during approval and construction of new industrial facilities	Industry & SME: ISO 50001 users, RECP, BAT, benchmarking	Start: 2015 End: 2020 (ongoing)	-	271,969	397,132	718,979	not impemented
IV.2	Increasing the efficiency of the central heating plants and suppli ers: Avan DH – cogeneration	Developed model of an efficient energy cogeneration and supply	Start: 2005 End: ongoing	57,228	67,327	70,693	77,426	partially implemented
IV.3	Implementation of EE Financing Facility for Industrial Enterpri ses	reported as part of scross sectoral measures						
IV.4	Natural gas savings through improvem ent of transmission pipelines and subst ations, and optimisation of existing boil er houses in TPPs	TPP 500 MW proposed by the WB to cover peaks and reserve margin, after the decommissioning of blocks 1-4 of Hrazdan TPP	Start: 2018 End: 2020	-	-	-	4,739,961	not impemented
IV.5.a	Reduction of energy losses in distribution networks: WB Electricity Supply reliability	energy generation, distribution	Start: 2015 End: 2060	-	-	-	2,560	not impemented

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
IV.5.b	Reduction of energy losses in distribution networks: EBRD Power Supply Reliability	reduced energy losses in distribution networks	-	-	-	3,311	3,311	not impemented
IV.5c.	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	Improved energy efficiency and energy savings of power sector	Start: 2012 End: 2017	-	-	18,000	18,000	not impemented
IV.5.d.	Reduction of Electricity Losses in Low-voltage networks, ArmElNet	reduced energy losses in distribution networks	Start: 2016 End: 2020		62,072	62,072	62,072	not impemented
IV.6	Wider Application of Renewable Energy: SWHs	The measure is designed on the basis of realized best practices and experiences.	Start: 2016 End: 2020 and beyond	5	10	12	16	new measure
IV.6.b	Geothermal Heat Pumps for Central Heating	space heating, energy efficiency, renewables, PPP	Start: 2016 End: 2020	-	705	705	705	new measure
IV7	Development of distributed RE generation through implementation of Net metering provision	Distributed generation, solar energy, autonomous electricity production, net metering	Start: 2016 End:ongoing	357	608	2,729	5,094	-
			Total MWH	**57,233**	**402,082**	**551,925**	**5,623,030**	
			Total TOE	**4,921**	**34,573**	**47,457**	**483,494**	

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
Transport/Mobility								
V.1	Development of legislative background regarding fuel efficiency and emission n orms of vehicles	regulatory measure, feasibility studies	Start: 2008 End: ogoing	-	-	-	-	partially implemented
V.2	Dissemination of information on technol ogies and approaches for reducing ene rgy consumption effectively	information	-	-	-	-	-	not implemented
V.3	Continuous exchange of mini buses by larger passenger buses	road transport	Start: 2012; End: 2017	821,022	1,045,391	1,118,245	1,267,202	partially implemented
V.4	Expansion and modernisation of the ele ctrified public transport system in the Ci ty of Yerevan	electric transport (metro)	Start: 2015 End: 2020	-	5,294	5,294	5,294	partially implemented
		electric transport (metro)	Start: 2016 End: 2020	n/a	n/a	n/a	n/a	pre-feasibility stage
V.5	Expansion and modernisation of rail tra nsport network (passenger and freight)	rail road transpot	Start: 2010 End: Ongoing	582	862	972	1,206	partially implemented
V.6	Continuous switching of road vehicles from gasoline to compressed natural gas (CNG)	road transport	Start: 2008; End: ongoing	n/a	n/a	n/a	n/a	partially implemented
V.7	Development of Integrated Electro-Transport Network and services to cover unmet demand in public transportation services in Yerevan	information, planning	Start: 2016; End: ongoing	-	-	-	-	-
			Total MWH	821,604	1,051,547	1,124,511	1,273,702	
			Total TOE	71	90	97	110	

No	Title of the energy saving measure	End-use targeted	Duration	Achieved (for 2014 only) or expected energy savings in target year (MWh)				Status in Relation to the 1st NEEAP
				2014	2017	2018	2020	
Agriculture								
VI.1	Rural development program: high efficiency agricultural machinery import	Farmers	Start: 2013 End: 2020	9	9	9	9	partially completed
VI.2	Importing high efficiency tractors, Japanese ODA	Farmers	Start: 2010 End: 2012	5	5	5	5	implemented as planned
VI.3	Irrigation system enhancement project, wb	Rural irrigation users;	Start: 2013 End: 2017	1,267	1,267	1,267	1,267	partially completed
VI.4	Irrigation rehabilitation emergency project, WB	Rural irrigation users;	Start: 2009 End: 2013	78	73	73	73	implemented as planned
VI.7	USAID Clean Energy & Water Program	Rural communities	Start: 2013 End:2015	150	150	150	150	implemented as planned
VI.10	Irrigation System Modernizaiton and Institutional Capacity Building, WB	Rural irrigation users; farmers	Start: 2016 End: 2020	-	19,000	19,000	19,000	new measure
VI.13	Energy efficient greenhouse	Private greenhouse sector	Start: 2011 End: 2020	-	425	480	591	partially completed
VI.15	Grading agricultural products based on quality	Processors, farmers	Start: 2016 End: 2020	-	8,620	25,900	51,700	new measure
VI.16	Renewing the agricultural machinary park	Farmers	Start: 2016 End: 2020	-	134	201	269	new measure
VI.18	Install gravity irrigation	Farmers	Start: 2016 End: 2020	-	17,200	34,500	51,700	new measure
		Subtotal (MWH)		1,508	19,223	19,223	19,223	
		Subtotal (KTOE)		0	2	2	2	
	Grant Total	MWH		1,294,646	2,366,267	2,655,651	8,144,536	
		KTOE		5,064	39,674	52,918	489,756	

2 MEASURES FOR THE PRIMARY ENERGY SAVINGS

Except for certain hydro-energy resources and a small amount of other renewables (including some fire-wood, the consumption of which led to severe deforestation), Armenia does not possess any own conventional (fossil and nuclear) fuel resources and is not a transit country for oil and gas as well. Thus, the country is heavily dependent on energy imports, which has placed an increasing burden on the current account. In 2012 energy imports amounted to 90% of the total of 3.377 Mtoe primary energy supplied. The share of energy imports in TPES fluctuates slightly depending on the hydro potential. In dry years, imports increase.

Although reduced during the recent years, overall energy losses are still high. About 30% of the total primary energy supplied was lost through transformation, transmission and distribution (USAID, 2014). This underlines the importance of energy infrastructure improvement and EE development. This is the reason why the IFI support requested by the Armenian Government in the energy sector also largely focuses on loss reduction, reliability and increased effectiveness of the distribution networks.

All EE measures that are provided by this program are measures for reduction of energy consumption among end users. The same applies and for EE measures which are taken in the power plants that generate electricity and thermal energy. It is necessary to emphasize that the implementation of measures at the site of energy end users is considerably more conducive to reducing the consumption of primary energy, compared to power plants that generate energy. The reason for this lies in the fact that the generation of energy, except losses during transformation of primary into secondary form of energy, appear and additional losses of transmission and distribution.

2.1 Reducing high-voltage network losses and Enhancing reliability of Power Supply in Armenia

Optimal approach is to predict the energy efficiency measures in all steps – at the side of power supply (production of transformed form of energy, transport, distribution) and at the side of the energy end users.

Table 7. Energy Losses in the Armenian Energy System

per year	2005	2010	2011	2012	2013
Losses in energy transformation (ktoe)		768.216	897.205	897.192	
Losses in electricity transportation (GWh)	97.23	101.43	137.2	145.8	138.7
Losses in electricity distribution (GWh)	810.00	705.40	766.8	803.5	810.0
Losses in centralised heat pipelines (TJ)			11.22	4.53	3.48
Losses in natural gas pipelines (million m^3)			134.35	139.00	141.63

As the above table indicates, the losses in transmission and distribution processes are significant and their mitigation is in the Government's list of priorities.

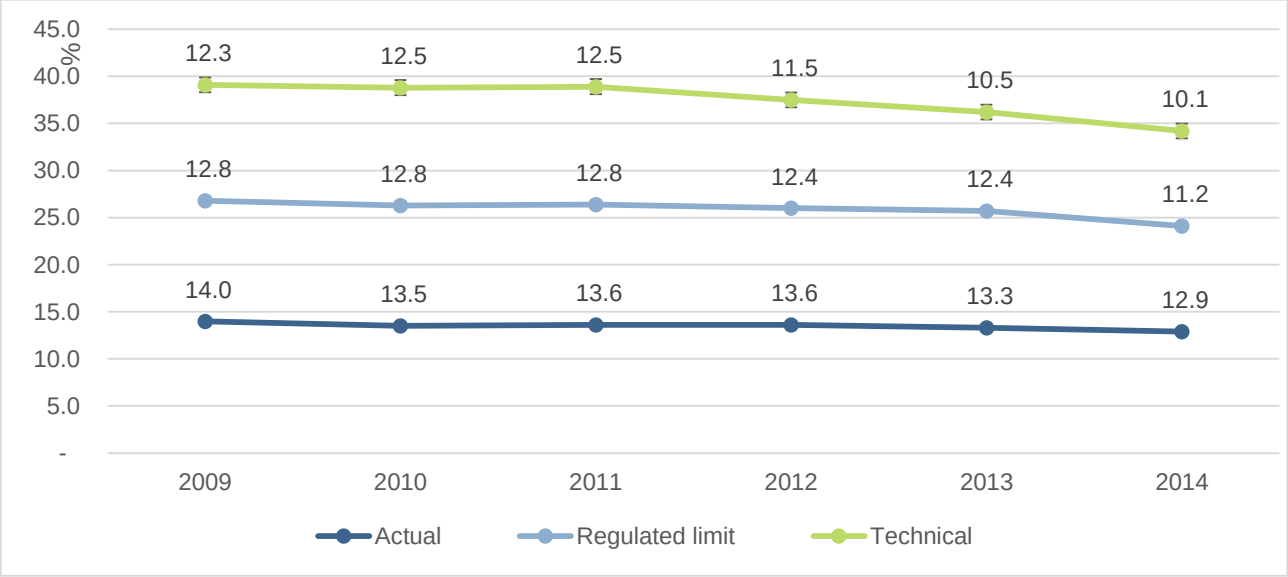
The planned projects which target loss reduction and efficiency in distribution networks include the following:

1. "EBRD -Armenia Power Supply Rehabilitation Project: Phase 1. Rehabilitation of 220 kV transmission network and substations in Armenia (EUR 65,000,000), of which :
2. "WB Electricity Supply Reliability Project. Rehabilitate key substation and transmission lines critical for system-wide reliability of power supply (US$ 41,550,000 for now) or US$ 66, 600,000) reducing system losses from 2.2-2.7 % to 0.7% reaching positive net economic benefit in 2030.

2.2 Reducing low-voltage electric network losses

In addition to the high-voltage network losses and reliability issues, losses remain higher than allowed by the regulator in the low-voltage networks operated by the Armenian Electric Networks.

Figure 11. Energy Losses in 0.38-110 kV network (% of energy entering the network)



Source: PSRC, 2015

The actual losses are about 10 percent higher than allowed by the Public Services Regulatory Commission. Hence, the second NEEAP must include measures for the reduction of the losses in the low-voltage networks.

In addition to the above, the lossess in the low-voltage network of the Armenian Electric Networks (ArmElNet) have persistently been beyond the regulated permissible level. See below table for details.

The losses visualized in Figure 11 are quantified along with the energy saving potential below in Table 8.

Table 8. Losses in ArmElNet System and Potential for Energy Saving

Losses, mln kWh	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
Actual	711.0	705.4	766.9	803.5	810.0	789.9	764.4
Regulated limit	650.0	668.8	721.8	732.6	755.2	685.8	702.4
Technical	623.7	651.2	703.3	679.3	635.2	617.3	651.7
Energy Saving potential, mln kWh	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
Total	**60.9**	**36.6**	**45.1**	**70.9**	**54.8**	**104.1**	**62.1**
Sale, mln AMD with VAT	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
mln kWh	5,089.7	5,213.1	5,636.6	5,923.5	6,076.9	6,141.9	5,680.3
mln AMD with VAT	107,297.9	116,519.8	125,810.8	131,801.5	155,916.9	188,178.2	137,587.5
Average system tariff, AMD/kWh	21.1	22.4	22.3	22.3	25.7	30.6	24.0
Cost Saving potential, mln AMD	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
Total	**1,284.7**	**817.6**	**1,006.9**	**1,577.5**	**1,406.3**	**3,189.3**	**1,547.1**

As the above table indicates, the ArmElNet has potential to save an average of 62 GWh energy per year which will result in an average of AMD 1.5 billion financial savings due to reduced commercial losses.

2.3 Promotion of EE-integrated renewable energy applications

As Armenia lacks own fossil fuel resources, energy efficiency (EE) and utilization of country's significant renewable energy (RE) potential are key to sustainable development and national security. In order to

facilitate investments in EE and RE solutions, and increase the use of clean, efficient, safe and affordable heating technologies the Government of Armenia has joined the donor community to create replicable technical and financial models for enhanced access to renewable energy use. The 2011 Renewable Energy Roadmap identified the RE technical-economic potential (e.g. almost 4 Terawatt-hours of solar photovoltaic (PV) electricity per year, and over 4 TWh in geothermal heat pumps). In 2013 the President of Armenia approved the National Energy Security Concept. In 2014 the Scaling Up Renewable Energy Program Investment Plan set targets for renewable energy development until 2025. The survey of Armenian RE equipment vendors conducted in June 2015 revealed that there is a notable growth trend in implementation of RE practices in many different sectors of the economy. The graph below illustrates the cumulative areas and capacity of installed solar panels by the local companies during last five years derived from the survey. While the trend is positive, the installed capacities are still less than 0,2% of the solar PV target set for 2020. The level of utilization of solar PV electricity can be promoted through possibilities of grid-connection and definition of parralel operation through net metering.

2.3.1 Enforcing Net Metering for Independent Solar Electricity Producers

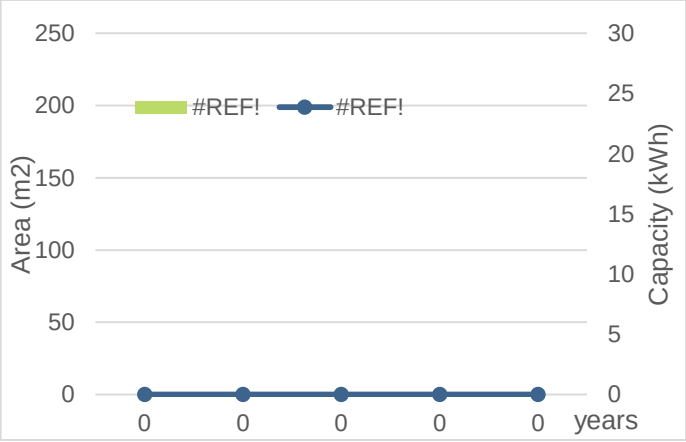


Figure 12. Solar PV Installations, 2011-2015

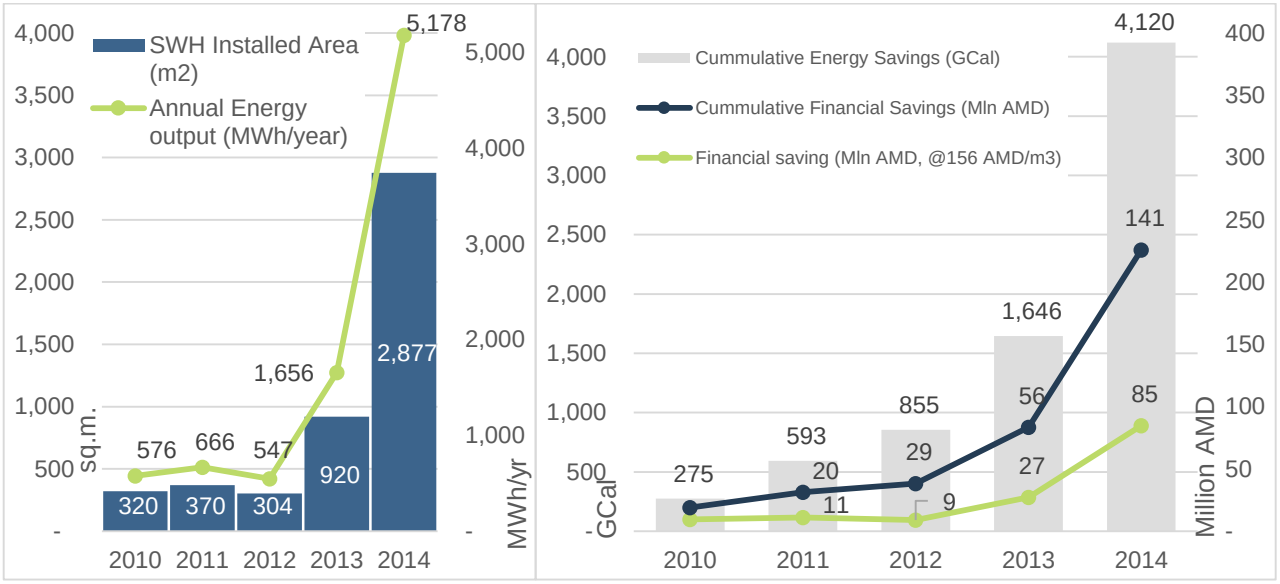
Net metering policies have facilitated the expansion of renewable energy through on-site generation, also known as distributed generation. Common distributed generation sources, which can be located at a house, school or business rather than utility-owned property, are solar panels, micro-turbines or other renewable energy sources. Increasing numbers of utility customers are using net metering to generate electricity from sources on their property. Net Metering provides PV customers with opportunity to have a zero charge against their electricity consumption if it is offset by the PV generation; in case they produce and export to the grid more energy than they consume, they will receive the relevant remuneration or, alternatively, will be charged for the excess consumption, if it exceeds the level of PV generation. The 2003 Law on Energy Saving and Renewable Energy created the legal provision for net metering. In 2005 the PSRC developed the procedures for parallel operation of autonomous renewable energy producers, which defined the non-commercial relationship of the electric network with the micro-generation facilities with capacity under 150 kW (PSRC Resolution №194, 30.11.2005). The regulation, however, has failed to be implemented

due to tax accounting issues, which require immediate solution. With the growing energy tariffs, the small-scale solare PVs systems hold a large potential to help develop the distributed RE generation.

2.3.2 Greater Use of Solar Thermal Energy

The solar water heaters' market has been evolving rapidly. A vendor survey conducted specifically for purposes of second NEEAP preparation revealed a trend much faster than expected (See Figure 13).

Figure 13. Estimated Trend of Installed Solar Water Heating Capacities: Output and Savings



The growing energy prices, the availability of loan financing from IFIs (EBRD, GGF, AFD, pending KfW's plans to diversify the current small HPP lending to also cover SWHs) for concentrated solar thermal technologies, have jointly lead to an expansion of the SWH capacities of over 4.7 MWh throughout Armenia in various consumer groups, which leads to annual cummulative thermal energy output of over 8,600 MWh per year as of mid-2015. If the growth trend continues, which is highly probable given the increased availability of loans and leasing schemes for SWHs, Armenia may accoplish more than the targets set for 2020 for SWH installed capacity and energy output (at current rate, by 2020 there will be 15 MW installed capacity, which is more than the SREP target by 5MW, similarly the energy output will be 25GWh per year instead of the 13 GWh / year set in the SREP Investment Plan.).[8]

2.3.3 Piloting Geothermal Heat Pumps for Scalable Centralized Heating Solutions

Another EE-integrated renewable energy solution for Armenia is geothermal heat pumps, which have been estimated to have significant potential for space heating. The Renewable Energy Roadmap of

[8]Scaling up Renewable Energy Program (SREP) Investment Plan, 2014.

Armenia has estimated maximum 75MW capacity for geothermal energy, which can be event more if utilized for supply hot water and heating to nearby locations.Unlike other countires, there is no applied experience of geothermal heat pumps' in Armenia. Development and piloting of geothermal district heating system for the resort town of Jermuk for supply to municipal, residential and commercial buildings (sanatoriums/spas), utilizing the water from local high-temperature mineral springs. Jermuk has a long heating season and high tourism traffic which creates need to supply high qualiity heating and hot water services to the multiple hotels and resort facilities. Should the system be found efficient in Jermuk, there is replication potential in other towns of Armenia.

Such investments have to be estimated for each particular site and terrain (variable borehole drilling cost), however, under Armenia's general circumstances a pilot project for a typial building 5-floor building is necessary to verify the cost-effectiveness and economic viability of this technology for heating residential and public buildings. It is key to seek a public-private partnership arrangements whereby a private energy service provider can partner with the local Government (Jermuk municipality, in this case) for utilization of municipal assets and private management, investment co-financing and know-how. At the same time, geothermal heat pumps for heating can reduce the demand for imported gas for heating purposes and associated greenhouse gas emissions, utilize indigenous clean and sustainable energy resource.

The assessment of the primary energy saving measures are presented in the section on Industry, Power and SMEs.

3 FINAL ENERGY SAVINGS IN THE END USE SECTORS

3.1 Review of final energy saving targets and final energy saving achievements

As Figure 14 indicates, Armenia's final energy consumption largely takes place in the buildings (residential, public and commercial) and the transport sectors. What is noteworthy, both sectors make only small insignificant contributions to GDP. Industry used only 18% of the energy, while selivering about 33% of the GDP. Commercial and public services accounted for about 16% and agriculture - for about 7%. The share of the residential sector fluctuates depending on weather conditions.

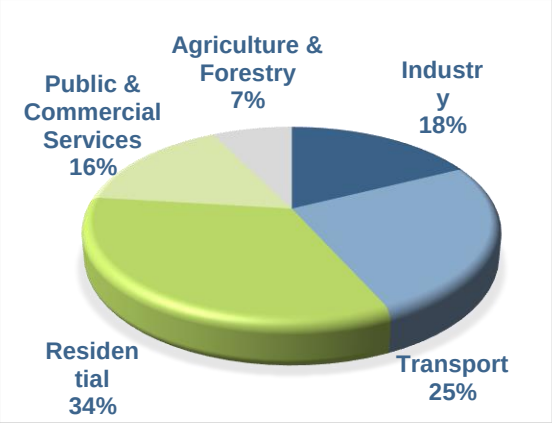


Figure 14. Structure of Final Energy Consumption by Sector, 2012

As the below figure indicates, the commercial, and the public service sector is the only one which showed steady increase of energy consumption over the last years. With the projected economic trends, the industrial energy use and buildings are expected to grow substantially and lead to a significant hike in the final energy consumption. The dinamics and forecast of final energy consumption is presented in Figure 15.

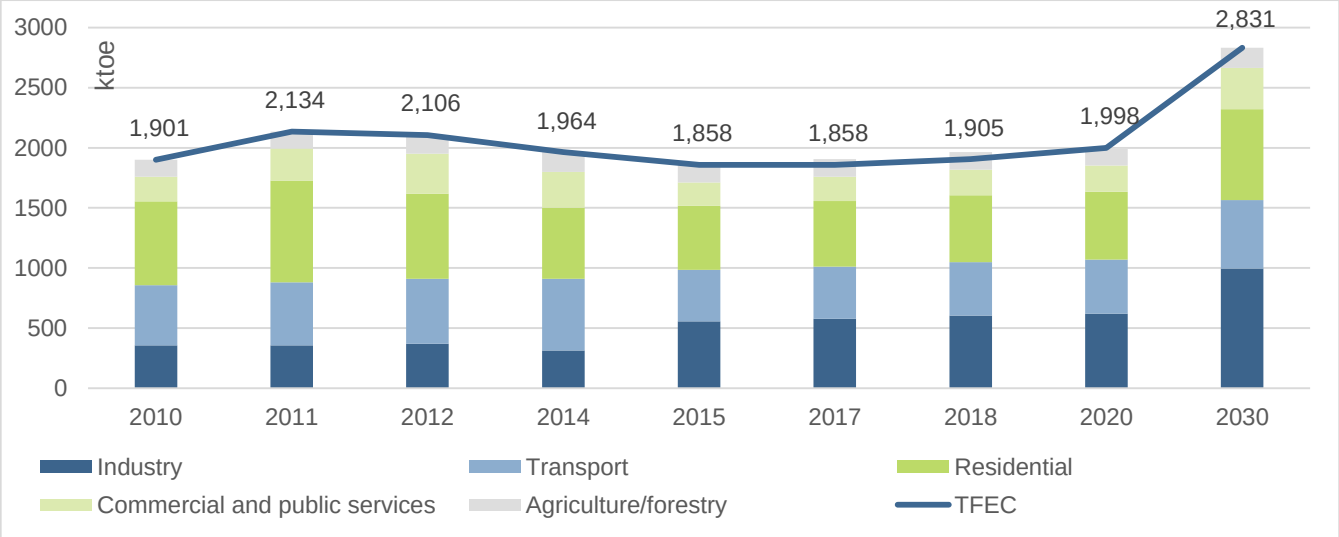


Figure 15. Final Energy Use Trend and Projections by Sector[9]

3.1.1 National overall end-use energy savings targets and progress towards them

3.1.1.1. Achievement of the 2014 intermediate energy end-use target

The 2010 energy balance was prepared shortly after the completion of the first NEEAP. The indicative target for the end of the first NEEAP was thus later quantified by the team developing the second NEEAP using the energy balance data for 2010.[10] Since the second NEEAP was prepared in 2015, the first period was assumed to cover 2011-2014. The energy saving target for the first period of the first NEEAP was baseline energy consumption of 2010 (1900.6 ktoe). The second NEEAP sets an interim target of 3.3%, equivalent to 63.3 ktoe. The assessment of the first NEEAP revealed that this target has been outperformed: The overall energy saving reached by 2014 was 6.3% (120.3 ktoe).

The second NEEAP continues the relevant measures from the first NEEAP, and in addition proposes an updated bundle of measures and energy saving targets for the second period, covering 2015-2017. The second NEEAP tracks both the indicative milestone year 2018, as well as a long-term plan until 2020. The document was prepared based on the template recommended by the Energy Community, in which the Republic of Armenia has had observer status since 01.10.2011.

In accordance with the NEEAP methodology, the baseline used in the second NEEAP is the average energy consumption from three consecutive years (2010, 2011 and 2012), in this case 2,047 ktoe. Based on the assessed progress under the first NEEAP and the expected impact of the ongoing and new energy efficiency improvement measures, the second NEEAP proposes a new set of targets for 2017 (9.9% instead of the 10.4% proposed in the first NEEAP),

[9]Source: USAID, 2012. Reference scenario for 2015-2030.
[10] EC-LEDS Program In Armenia.

for 2018 (11.2% instead of 13.8%), and a higher overall target for 2020 (34.2% instead of 22.3%).

Table 9. National Indicative Targets under the Second NEEAP

National indicative target in 2020 (ktoe)			422.2		
National indicative target in 2018 (ktoe)			282.0		
National intermediate target in 2017 (ktoe)			212.6		
National intermediate indicative target in 2014 (ktoe)			120.3		
	Sector target In 2014 (ktoe)		Revised estimated energy saving target		
			(ktoe)		
Sector division of target	Target	Achieved	2017	2018	2020
Horizontal and CC	-	35.5	40.6	43.1	48.2
Residential	18.8	0.1	31.3	34.1	51.4
Services	3.5	0.0	4.9	5.3	6.1
Industry	24.0	13.9	34.6	47.5	483.5
Transport	15.5	70.6	90.4	96.7	109.5
Agriculture	1.5	0.1	1.7	1.7	1.7
Total:	63.3	120.3	203.5	228.3	700.3
Percentage (%)(compared to reference consumption)	3.3%	6.3%	**9.9%**	11.2%	**34.2%**

It is noteworthy that some of the ongoing energy efficiency programs in Armenia, particularly those financed by international financial institutions and the banking sector, have been assessed in depth for past performance, but were reluctant to provide any projections of future lending due to market volatility. For this reason, the reduced targets of the second NEEAP may be outperformed when energy efficiency financing is quantified in the third NEEAP.

3.1.1.2. Expected savings in relation to the 2018 overall energy end-use target

New measures are introduced in all sectors second NEEAP. These measures primarily relate to enforcing new regulations, integrating energy efficiency into public procurement, encouraging improved energy performance of industrial and SME energy consumers, promoting end-use distributed generation of electricity and thermal energy by energy end—

users, as well a introducing a comprehensive monitoring and planning approach for the transport sector.

Table 10. Overview of targets and achieved/projected energy savings both in respect of primary and final energy

	Final energy saving target		***Primary Energy Saving Target***	
	in absolute terms (toe)	*Percentage (%)(compared to reference final consumption)*	*in absolute terms (toe)*	*Percentage (%) (compared to reference primary energy consumption)*
2014(interim period)	*115.4*	*6.1%*	*4.9*	*0.16%*
2017(interim period)	*192.3*	*1.1%*	*11.2*	*0.04%*
2018 (overall period)	*215.0*	*1.2%*	*13.3*	*0.05%*
2020 (extended period)	*278.6*	*1.6%*	*421.7*	*1.46%*

This primarily concerns the increased use of solar energy for hot water preparation, but also significant attention and application of heat pumps and increased use of solar photovoltaic technology via net metering. Envisaged measures are closely related to strategic documents, action plans and promotional measures for greater use of renewable energy.
The national intermediate indicative targets for 2017 and onward was calculated on the basis of the average final consumption of energy during the realization of first NEEAP.

Table 11. National indicative targets

Indicative target in 2017 (ktoe)	**10%**	
Realized savings in 2014 (ktoe)	6%	
Sector	Sector target	
	2017 (ktoe)	%
Horizontal	40.6	4.17%
Residential	31.3	1.84%
Public sector	4.9	9.55%
Industry	34.6	17.67%
Transport	90.4	1.13%
Agriculture	1.7	9.94%
Total:	**80.06**	100.00%

A significant number of strategic documents and regulations have been adopted in the Republic of Armenia. Those documents contain various activities related to the implementation of EE measures. The impact of these individual actions can hardly be separated and difficult to

evaluate due to their combined nature and overlapping results. For this reason, when there are no defined standards and methods for this purpose, the effect of these measures cannot be accurately assessed.

The climate change mitigation potential of the second NEEAP measures has been assessed ad is presented below in Table 12.

Table 12. Tons of CO2 emission avoided by target year based on Sectoral Measures

Sectors	Tons of CO2 emission avoided by target year			
	2014	**2017**	**2018**	2020
Horizontal and CC	183,156.88	209,514.79	222,693.74	249,051.65
Buildings (Residential)	1,366.26	28,860.00	28,860.00	28,860.00
Public Buildings and Services	186.32	25,493.02	27,292.80	31,249.79
Industry	158.36	270.13	1,211.54	2,261.54
Transport	31.37	40.15	42.93	48.63
Agriculture	-	7,636.80	15,318.00	22,954.80
Total GHG Avoided (tons CO2)	183,532.93	271,814.88	295,419.02	334,426.40

A combination of top-down and bottom-up methodologies was used. For the implementation of the proposed set of energy efficiency measures, it was necessary to strengthen the institutional support, especially in buildings. Adoption of the new Housing Legislation – stipulating that every multi apartment facility must operate as a legal entity – to form a community of tenants of the building or delegate the housing maintenance function to a professional organization, is a big step forward in the legislation, which, combined with the enforcement of the amended Law on ES & RE and the secondary legislation, should enable faster renovation of these buildings. Establishment of Home-Owners association will ensure higher quality of housing maintenance and potentially - implementation of thermal modernization of buildings. This process is envisioned with the establishment of private maintenance companies and development of ESCO services, too.

Monitoring of the implementation of the second NEEAP and reporting results based on measuring and verification of energy savings are under responsibility of the Ministry of Energy and Natural Resources. In order to monitor the actual energy savings and to avoid problems related to the lack of data needed to calculate the savings from individual measures, which was present in the preparation of this NEEAP, the MoENR must establish an information system to track all activities of energy efficiency and energy savings assessment. Tasks can be assigned (outsourced) to expert teams outside MoENR, if necessary.

Realistic and stable funding sources for the implementation of the second NEEAP have to be provided in most of the extra-budgetary sources of financing and market mechanisms. The second NEEAP

includes measures which still do not have committed funding. A very small part of budgetary resources (Central and Local) have to be allocated, for the drafting of the policies, development of tariff reform, preparation of the programs within the specific measures, however significant funds will be necessary for the implementation of the energy efficiency investments will remain under the funding of the donors and IFIs.

3.1.2 National targets for nearly zero energy buildings

Armenia has not formally established a national target for nearlyzeroenergy buildings – buildings with energy consumption close to zero. Nevertheless, several steps have been taken to support buildings beyond the current codes' requirements. These initiatives are aimed at a broader of green architecture, sustainable communities, smart cities and green economy.

These initiatives particularly include the following:

- Drafting of the Law on Yerevan City Center, with beyond codes ambition for energy performance in new construction if it is to happen in the Center of Armenia's capital;
- Drafting of Law on Green City of Dilijan, Tavush Marz
- Developing a dialogue and concept for smart cities in Armenia with the example of Goris, Vayots Dzor Marz.
- Avedisian School and Community Center in Yerevan's Malatia-Sebastia district was constructed as a "green" building and was certified for Leadership in Energy and Environmental Design (LEED), utilizes renewable energy and is low-carbon footprint.UNDP estimated that energy consumption in the building will be reduced by 30 percent, which is even a stricter criteria than required in the EU and the US. The green roof of the school will provide insulation, lowering heating and cooling costs. Rainwater will be filtered and stored to water plants, shrubs, and provide water for the grass on the soccer field.
- UWC Dilijan College built in Tavush Marz was built and certified as good by the Building Research Establishment Environmental Assessment Methodology (BREEAM)[11]. The building has a green roof, green walls and holistic building management system (BMS), meets high standards for health, environment, life security, water, materials, recycling, ecology, land-utilization and pollution as well as based on the impact of its use on the environment.

[11]See more at: arka.am/en/news/economy/uwc_dilijan_college_first_breeam_certified_in_armenia/#sthash.e7FLUxc4.dpuf

- Educational curriculum and courses were developed and delivered on integrated building design and energy efficient construction, supported by UNDP/GEF and ITS.

While having no international obligation for transposing any directives or international standards for nearly zero, green or passive buildings, Armenian Government and business community voluntarily endeavors tosupport the construction of new nearly zero energy buildings and the achievement of thislevel of energy performance in the refurbishment of existing buildings.

Basictasksforthisperiodincludeeducation ofdesignersas well as providingtraining for developers, architects and contractors. Thistaskwill be carried outin parallelwiththe determinationof criteria for priorityareas for implementation, constructionofpilotsites andthe definitionofmomentumfor the implementationofthesemeasures to complywith thefinancial resources. Due to the voluntary nature of this process, it can only be promoted through certification, recognition and publicity of such accomplishments, which through professional associations and academia can set the tradition and culture for nearly zero energy performance in construction.

3.2 Horizontal Measures

The first NEEAP set forth a set of horizontal measures in seven key areas, largely directed at the legal-regulatory framework, capacity building and financing for energy efficiency. Considering the horizontal nature of these measures, their quantitative assessment is presented among the respective sectoral measures.

Table 13. First NEEAP Assessment: Cross-cutting/Horizontal Measures (without quantitative impact)

I.	Horizontal measures		Description of the energy saving measure	End-use targeted	Duration

I.1	Implementation of a regular national " Energy Statistic" (with annual updates)	I.1	USAID LEDS Program supported development of national energy balance according to IEA and Eurostat requirements for years 2010-2012. The National Statistical Service, Ministry of Energy and Natural Resources and INOGATe Technical Secretariat have signed a memorundum on "Cooperation in the field of statistics" including an action plan related to sctions necessary the energy balance. However, no regular procedure for routine preparation of energy balances for following years was put in place.	horizontal	2010-2012
I.2	Implementation of a "National Energy Agency for Energy Efficiency and Renewable Energy"	I.2	The National Agency was not established, instead the R2E2 has been tasked with many of the functions that traditionally national agencies perform.	horizontal	
I.3	Financial Support for Energy Efficiency measures in all Sectors	I.3	Over $86 million has been committed to energy efficiency and EE-integrated renewable energy investment during 2010-2014 via various donors and IFIs, such as WB, IFC, GEF, EBRD, IFC, GGF, EIB, KfW, and UNDP. In addition, these donor and IFI funds have had a market transformation impact on the financial services sector. According to Econoler experts' estimations, the local financial institutions and universal credit organizations have also tapped into this market and financed EE & RE investments from own resources in addition to on-lending portfolio with the IFIs. By expert assessment, over $420 million has been invested by LFIs and UCOs in diverse loans, with average equity financing of 17.5% which leverages approximately $89 million in equity participation. Overall, it can be concluded that approximately $595 million has been invested in energy efficiency and EE-integrated RE solutions during 2010-2014. Quantified separately in **Table 14**	horizontal	2010-ongoing
I.4	Information campaigns, training and education in the area of energy efficiency improvements	I.4.a.	Awareness raising compaigns by UNDP/GEF, R2E2, INOGATE	horizontal	2012-2015
		I.4.b.	Professional trainings by UNDP/GEF, R2E2, INOGATE, EBRD	horizontal	2012-2015
I.5	General Regulatory demand-side measures	I.5.a.	Amendments to the Law on Energy Saving and Renewable Energy	horizontal	2012-2015
		I.5.b.	The draft RA Law "On making an addition into the RA law "On urban development" submitted to the Ministry of Urban Development dated July 13, 2013	horizontal	2013-2015
I.6	Removing inadequate gas & electricity tariff structure to encourage energy savings	I.6	Revise tariff structure: Remove perverse tariff incentives that are accelerating winter electricity consumption and unnecessary gas consumption by public facilities and commercial establishments.	horizontal	not implemented

The regulatory initiatives which are cross-cutting but also concern the buildings sector and which have contributed to the achievement of the first NEEAP targets is presented below (the complex programs and initiatives which have both a regulatory and a financial element are presented in the Financing section.):

Table 14. Summary of Cross-cutting Measures With Quantative Energy Saving Impact

No	Title of the energy saving measure	End-use targeted	Duration	Achieved/Expected energy savings in target year (MWh)				Status in relation to 1st EEAP
				2014	2017	2018	2020	
I.3.a.	Financing for Energy Efficiency: GGF	EE and RE solutions for households space heat and lighting efficiency (windows, doors,heat supply, lighting, distribution systems) and SMEs	Start: 2014 End:: 2020 (ongoing)	35,069	35,069	35,069	35,069	partially implemented
I.3.b.	Financing for Energy Efficiency: IFC EE loans for households and SMEs	residential energy end-use, SME EE of production processes, space heat conservation	Start:2009 End: 2015	35,792	35,792	35,792	35,792	partially implemented
I.3.c.	Financing for Energy Efficiency: Energy efficiency loans for residential and business clients, EBRD ArmSEFF	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)	Start:2006 End: 2015	341,655	341,655	341,655	341,655	partially implemented
I.3.d.	Financing for Energy Efficiency: Eastern European Energy Efficiency and Environment Partnership (E5P)	faclitation of energy efficiency finance in municipal infrasturcture with grant co-financing	Start: 2015 End: ongoing	n/a	n/a	n/a	n/a	initializing, tracked as part of other measures
I.6.	Removing inadequate gas tariff structure to enc ourage energy savings	Developing a revised tariff structure which would not penalize SMEs and autonomous heating systems	Start: 2016, ongoing		59,365	89,047	148,412	not implemented
I.7	Support to Armenian Municipalities in Sustainable Energy Action Planning	municipal infrastructures, building sector, households	Start: 2015; End 2020	3,056	22,811	31,961	51,083	new measure
	Total (MWh)			412,516	471,880	501,562	560,927	
	Total (KTOE)			35.47	40.57	43.13	48.23	

The individual measures are presented below. These individual financial programs have been intergated in their respective sectoral programs to assess the impact on the sector. Those financiers, whose efforts are aimed at more than one sector, are described below.

Title of the Measure		***Green for Growth Fund Support the development of an energy efficiency lending product within the institution, enabling households in Armenia to reduce energy costs, consumption and CO2 emissions.***
Index of the measure		**I.3.a.**
Description	**Category**	EE Programs and Measures, EE finance, cross-sectora
	Timeframe	Start: 2014
		End: 2020
	Aim/brief description	On-lending via local banks to create credit lines for EE loans for households and businesses with the aim to reduce energy consumption and increase energy efficiency.
	Target end-use	EE and RE solutions for households space heat and lighting efficiency (windows, doors,heat supply, lighting, distribution systems) and SMEs
	Target group	Support to lending instiutions for creating energy efficiency and renewable energy (EE/RE) lending products as well as in setting up an overall EE/RE lending and marketing strategy. This embraces the creation of an EE/RE lending policy, the design of new retail, SME and corporate loan products and the organizational implementation of EE/RE lending. Furthermore, this type of project promotes establishing partnerships with local suppliers of EE/RE equipment and technology, and supports marketing and public awareness events, thereby boosting EE/RE lending activities of Financial Institutions.
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Establishing EE/RE Lending at Financial Institutions Supporting eSave Implementation Capacity Building for Financial Institutions for Renewable Energy Lending Energy Audit Services EE Showcase Projects Environmental & Social Standards Awareness Raising & Market Enabling Activities
	Budget and financial source	$ 15,354,000.00
		GGF
	Implementing body	ACBA, ACBA Leasing, Ineco and Ararat Banks
	Monitoring authority	GGF
Energy savings	**Method for monitoring/ measuring the resulting savings**	bottom up
	Savings achieved in 2014 as per 1st EEAP	35,069

	Expected energy savings in 2017 (MWh)	35,069
	Expected energy savings in 2018 (MWh)	35,069
	Expected impact on energy savings in 2020 (if available)	35,069
	Assumptions	Assuming that lending will remain at the same rate. Note: GGF has not provided projections of future lending
	Overlaps, multiplication effect, synergy	financing covers residential, commercial and industrial sectors

Title of the Measure		**IFC EE loans for households, Industry and SMEs**
Index of the measure		**I.3.b.**
Description	**Category**	EE Programs and Measures
	Timeframe	Start: 2009
		End: 2015
	Aim/brief description	Sustainable Energy Finance Projects working with Byblos Bank on EE lending for households and HSBC for EE in SMEs
	Target end-use	residential energy end-use, SME EE of production processes, space heat conservation
	Target group	Household and SME EE lending
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure (Source: http://www.WorldBank.org/content/dam/WorldBank/document/Armenia-Snapshot.pdf)**	With the support of the Government of Canada, IFC has partnered with HSBC Bank Armenia to expand the financing of renewable energy and energy-efficiency projects, promoting the efficient use of resources and reducing GHG emissions. It has provided HSBC Bank Armenia with a US$30 million loan, including US$8 million from the IFC-Canada Climate Change Program, and advisory support from the Armenia Sustainable Energy Finance Project. The advisory services from IFC support energyefficient and renewable energy projects for MSMEs in Armenia. So far, the bank has financed nine projects with expected energy savings of 35,792 MWh per year (MWh/y) and an expected annual GHG emission reduction of 6,614 tCO2e

		IFC funding, along with advisory supportfrom the Armenia Sustainable Energy FinanceProject, is being provided to Byblos Bank Armenia to increase access to housing finance and support Armenia's first residential energyefficiencylending packages offered by a local bank. So far, the bank has financed 59 projects with expected energy savings of 801 MWh/y andan expected annual GHG emission reduction of401 tCO2e. Advisory support from IFC also helps partnerbanks design renewable energy and energyefficiencyfinancing products, encouraging them to adopt international environmental and social standards and contribute to decreasing GHG emissions.
	Budget and financial source	$ 40,000,000.00
		International Finance Corporation (IFC)
	Implementing body	HSBC (industrial) and Byblos Banks (residential)
	Monitoring authority	IFC
Energy savings (MWh)	**Method for monitoring/ measuring the resulting savings**	not available
	Savings achieved in 2014 as per 1st EEAP (MWh)	35,792
	Expected energy savings in 2017 (MWh)	35,792
	Expected energy savings in 2018 (MWh)	35,792
	Expected impact on energy savings in 2020 (if available) (MWh)	35,792
	Assumptions	Lending will stop in 2015 and past investments will continue to yeild savings
	Overlaps, multiplication effect, synergy	financing covers residential, commercial and industrial sectors

Title of the Measure		**EE Finance: EBRD ArmSEFF (Energocredit) Energy efficiency loans for residential and business clients**
Index of the measure		**I.3.c.**
De	**Category**	EE Programs and Measures
	Timeframe	Start: 2006
		End: 2020

	Aim/brief description	Armenia Sustainable Energy Financing Facility (ArmSEFF) has set up the EnergoCredit facility aimed at providing energy efficiency loans for residential and business clients. On the other hand, has been working with MUD to assess the market for residential energy efficiency lending which would target the energy saving potential in existing residential buildings. Private companies and individuals who pursue highest energy efficiency standards and take out an Energocredit loan will be rewarded through 10-15% cash back payment from EU Neighbourhood Investment Facility (EU-NIF) to reward environmentally friendly investment.
	Target end-use	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)
	Target group	Residential and business cleints
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Energocredit loans are provided for investments in energy efficiency and in renewable energy projects. Energocredit Partner Banks go beyond financing eligible and energy efficient materials and equipment. Other projects of extended scope are also eligible after Energocredit expert review. Actions include energy efficiency and RE in residential, food processing, agriculture, manufacturing, industry, and construction sectors.
	Budget and financial source	$ 28,000,000
		EBRD
	Implementing body	ArmSEFF/Energocredit with 6 partner banks
	Monitoring authority	EBRD
Energy savings	**Method for monitoring/ measuring the resulting savings**	EBRD internal procedures
	Savings achieved in 2014 as per 1st EEAP (MWH)	341654.51
	Expected energy savings in 2017 (MWH)	341654.51
	Expected energy savings in 2018 (MWH)	341654.51
	Expected impact on energy savings in 2020 (if available) (MWH)	341654.51
	Assumptions	No new lending volumes have been estimates beyond 2014, which is unlikely, however it was not possible to make assumptions on future lending volumes as no lending forecast has been provided by EBRD

	Overlaps, multiplication effect, synergy	due to mixed nature of EBRD EE lending, overlaps with all sectoral measures for which financing is made availanle

Title of Measure		**Eastern European Energy Efficiency and Environment Partnership (E5P) grant co-financing of EE lending**
Index of the measure		**I.3.d.**
Description	**Category**	EE Programs and Measures
	Timeframe	Start: 2015; ongoing
	Aim/brief description	Membership in the Eastern Europe EE and Environment Partnership (E5P) will enable implementing very important EE projects. The Government of Armenia signed the Contribution Agreement with EBRD, the Fund manager, on 16 March 2015 and will make its first installment in accordance with the timeline specified in the contribution agreement.
	Target end-use	EE loans
	Target group	Municipalities, SME and households
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Energy efficiency improvements and GHG emission reduction in: • District Heating; • Water and Wastewater; • Solid Waste Management; • Street Lighting; • Insulation of public buildings or residential housing • Urban Transport.
	Budget and financial source	€ 21,000,000 RA (1 M EUR), MoE Grant (20 M EUR) and E5P
	Implementing body	E5P Secretariat (EBRD), Ministry of Energy and Natural Resources
	Monitoring authority	EBRD
Energy savings	**Method for monitoring/ measuring the resulting savings**	n/a
	Savings achieved in 2014 as per 1st EEAP	n/a
	Expected energy savings in 2017 (MWh)	n/a
	Expected energy savings in 2018	n/a
	Expected impact on energy savings in 2020 (if available)	n/a

	Assumptions	the fundgins is fully disbursed
	Overlaps, multiplication effect, synergy	The E5P grant fundings is not used separately for project financing, but only to provdie1/3-1/4 grant co-financing for member IFIs (EBRD, WB, IFC, KFW)

Title of Measure		**Gas price reform to eliminate disincentive for EE**
Index of the measure		**I.6.**
Description	**Category**	regulatory measure
	Timeframe	2016-ongoing
	Aim/brief description	Removing inadequate gas tariff structure to encourage energy savings
	Target end-use	gas-fired space heating
	Target group	buildings, SME
	Regional application	national
Information on implementation	**List and description of energy saving actions substantiating the measure**	Developing a revised tariff structure which would not penalize SMEs and autonomous heating systems. The users between 10,000-12,000m3 will each save (avoid using) an average of 1,800m3
	Budget and financial source	n/a
	Implementing body	MoENR, PSRC
	Monitoring authority	MoENR, PSRC
Energy savings	**Method for monitoring/ measuring the resulting savings**	regular reporting by GazProm to PSRC
	Savings achieved in 2014 as per 1st EEAP	59,365
	Expected energy savings in 2017 (MWh)	59,365
	Expected energy savings in 2018	59,365
	Expected impact on energy savings in 2020 (if available)	59,365
	Assumptions	an administratively feasible solution is found
	Overlaps, multiplication effect, synergy	Eliminated disincentive in the tariff structure will create incentives for efficiency in conservation among medium-size gas consumers, such as building-level heating systems, hospitals, schools, etc

Title of the Measure		***Support to Armenian Municipalities in Sustainable Energy Action Planning***
Index of the measure		**I.7.**
Description	**Category**	EE Programs and Measures, EE Finance, cross-cutting

	Timeframe	Start: 2015; End 2020
		End: ongoing
	Aim/brief description	European Covenant of Mayors efforts in Armenia is gradually evolving with now 10 signatories, of which 3 cities already have their Sustainable Energy Action Plans (SEAPs), the remaining 7 are scheduled to have their SEAPs by the end of 2015, however lack substantially capacity to make progress in this direction on their own.
	Target end-use	municipal infrastructures, building sector, households
	Target group	communities, residential sector, cross-cutting
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	1. Introducing municipal energy management system in public institutions, 1.a. Capital repair and thermal modernization of municipal buildings ; 1.b.Insulation, window & door replacement, efficient lighting in kindergartens, culture centers, art schools, administrative buildings, etc.
		2. Energy efficiency retrofits of multi-apartment residential buildings : Insulation, Efficient doors and windows; Improved lighting
		3. Energy efficiency upgrades in public lighting system
		Public spaces / courtyards
		4. Efficiency Municipal transport; Road network optimization; Development of bike lanes and pedestrian commute
		5. Renewable Energy Development: Increased public awareness on sustainable energy and energy efficiency
		6. Informationa: Trainings and capacity building, Energy days, Earth Hour; Energy Certification of buildings;
		7. Rehabilitation of green spaces
	Budget and financial source	$ 11,000,000
		European Commission, Municipalities, other funds
	Implementing body	Energy Cities support program COMO-East, CoM signatories
	Monitoring authority	Energy Cities

Energy savings	**Method for monitoring/ measuring the resulting savings**	SEAP methodology by Energy Cities
	Savings achieved in 2014 as per 1st NEEAP (MWH)	3,056
	Expected energy savings in 2017 (MWh)	22,811
	Expected energy savings in 2018 (MWH)	31,961
	Expected impact on energy savings in 2020 (MWH)	51,083
	Assumptions	assuming that financing will be made available
	Overlaps, multiplication effect, synergy	EEIMs in other sectoral programs and financing schemes may overlap as local authorities are free to enroll financing for SEAP implementation. HFHA SUDEP project is already targetted at SEAP implementation Spitak and Vayq cities. The task also is in synergy with Armenia's committments under the UNFCCC

3.2.1 Financial Support for Energy Efficiency in All Sectors

As discussed with the stakeholders, the second NEEAP devotes more attention to the investment framework than the first NEEAP. The purpose of this focus is to analyze the availability, nature and direction in which investment finance is available for energy efficiency improevement measures. This analysis then allows to identify the gaps where investments are not supplied by the banks, donors and IFIs, and invite decision-makers' attention to this issue and recommend interventions.

The figure below provides an at-a-glance overview of the major donor and IFI funding directions in the field of energy efficiency, followed by an analysis of the various investment flows, supplied lending as well as the unmet demand for investment finance.

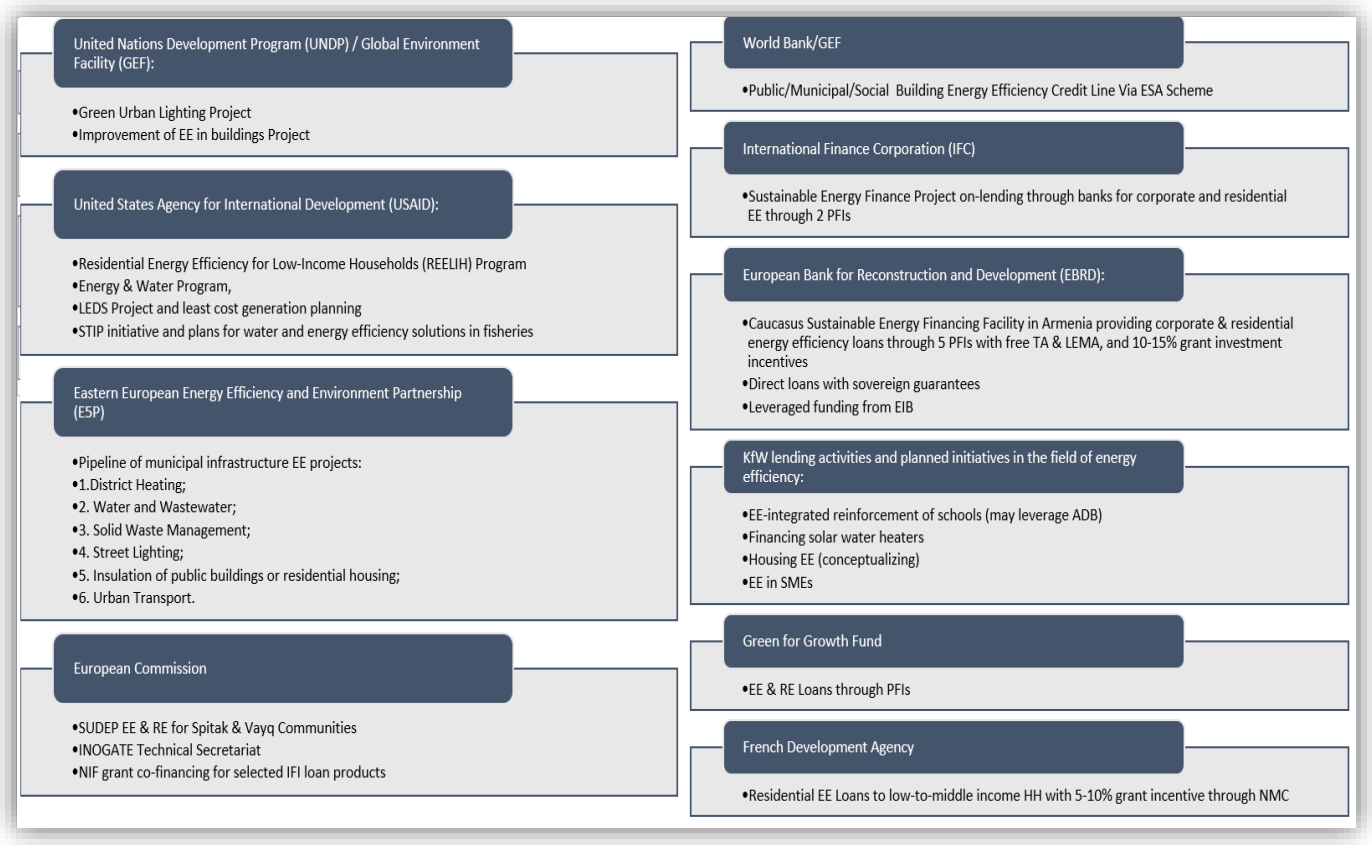


Figure 16. Overview of the major donor and IFI funding directions in the field of energy efficiency

Renovation and new construction in the public sector is largely financed by the World Bank (through different PIUs and R2E2 Fund), including social investments, major infrastructure projects in irrigation, construction and reconstruction of public buildings, as well as energy efficiency for public/social/municipal sectors. In addition, during the middle of 2014 KfW has been discussing the possibility of a concessional loan for energy efficiency renovation of schools with Ministry of Finance and MUD, potentially with participation from the Asian Development Bank (ADB).

The European Commission has recently been supporting the municipal energy efficinecy initiatives within the scope of the Covenant of Mayors and the Sustainable Energy Action Plans by Armenian signatory cities.

Other FIs (EBRD, AFD, IFC, GGF, KfW) are implementing or planning credit facilities for the residential sector, predominantly through participating banks / credit institutions and offering energy efficiency loans

for household energy efficiency retrofits, however none of them offer residential EE financing for building-level solutions.

As part of these IFI-funded credit lines numerous commercial banks have access to credit specifically for energy efficiency activity:

› In 2012 the GoA approved EE project under the WB financing implemented by R2E2 fund. The project is targeted to implement energy saving activities in public facilities to reduce the level of energy consumption by social and other public facilities. The cost of the project estimated to be about 10.7 mln USD.

› The R2E2 Fund is involved in BSBEEP-Black See Buildings Energy Efficiency Plan Project (2013-2015) within EU funded Black See Joint Operation Programme with the overall objective of strengthening the administrative capacity of local authorities and exchange good practice knowledge in energy efficiency in buildings.[12]

› UNDP/GEF is implementing a project aimed at Improving Energy Efficiency in Buildings including massive support to the Armenian Government in transposition of EPBD, development of secondary legislation for EE in buildings, as well as funding the first pilot thermal modernization of a residential multi-apartment building in Avan district of Yerevan, as well as social housing in Goris and Akhouryan towns.

› United Nations Development Program (UNDP) / Global Environment Facility (GEF): Green Urban Lighting: This is a grant-funded project aiming at reducing emissions of greenhouse gases by increasing energy efficiency of municipal lighting in the cities of Armenia via implementation of municipal investment programs and national policies. The project is in compliance with the national priorities to strengthen the economic and energy independence of the Republic of Armenia by promoting resources efficient and climate resilient growth. The project covers (A) municipal energy audits and technical capacity-building; (B) demonstration projects; (C) replication via municipal lighting programs and associated financial instruments; and (D) national policies, codes, and standards on lighting[13].

› Ararat and ACBA Banks have received multi-million credit lines for EE loans from the Green for Growth Fund,

› International Finance Corporation (IFC): Sustainable Energy Finance Project is working with Byblos Bank on EE lending for households and HSBC for EE in SMEs

[12] BSBEEP – Black Sea Buildings Energy Efficiency Plan, http://bsbeep.com/
[13] Green Urban Lighting UNDP-GEF/00074869. Republic of Armenia. BRIEF PROJECT DOCUMENT, UNDP January 2014

› AFD works with National Mortgage Company and 14 PFIs on household energy efficiency loans and EE mortgage loans with an overall EUR 10 million credit line and a target of 3000 households to be reached within the first year of the program,

› Under the European Bank for Reconstruction and Development (EBRD): Armenia Sustainable Energy Financing Facility14 has set up the EnergoCredit facility which provides energy efficiency loans for residential and business clients. On the other hand, has been working with MUD to assess the market for residential energy efficiency lending which would target the energy saving potential in existing residential buildings.

› Habitat for Humanity Armenia has worked with Inecobank on residential energy efficiency upgrades serving a total of 99 families in 3 buildings, with a total disbursement of roughly USD$ 6,000 per building and is the only entity that has succeeded in extending a bank-based commercial loan to a condominium in Armenia to 6 condominiums, more pending within their ongoing USAID-funded Residential Energy Efficiency for Low-Income Households (REELIH) program, as well as the SUDEP Project financed by European Commission for EE and RE projects in Spitak and Vayq communities, as signatories of the Covenant of Mayors.

› Ameria Bank also has household and SME EE Loan product supported with own financial resources

› Membership in the Eastern Europe EE and Environment Partnership (E5P) will enable implementing very important EE projects. The investment from Armenia will amount to about €1 million to be paid in portions and in addition to which Armenia will be granted nearly €20 million. Armenia did not yet pay the first portion of the membership fee to commence the projects. On 8 April 2014 the MoE has received a letter from EBRD informing that three countries (Czech Republic, Poland and Sweden) have already contributed to Armenian window in total €1.84 mln. The Government of Armenia signed the Contribution Agreement with EBRD, the Fund manager, on 16 March 2015 and will make its first installment in accordance with the timeline specified in the contribution agreement.

› KfW and the Republic of Armenia have signed the Inter-Governmental Agreement on three new loans aimed at:
  - EE integrated reinforcement of Schools
  - EE credit line for SME ; and
  - Housing EE credit line

› Also gradually evolving are the European Covenant of Mayors efforts in Armenia, with now 10 signatories, of which 3 cities already have their Sustainable Energy Action Plans (SEAPs), the

[14] Armenian Sustainable Energy Financing Facility (ArmSEFF), http://www.energocredit.am/. **Is Energocredit and Armenia Sustainable Energy Financing Facility the same???**

remaining 7 are scheduled to have their SEAPs by the end of 2015, however lack substantially capacity to make progress in this direction on their own.

› EU-funded INOGATE programme[15] - Armenia participated in the EU-funded INOGATE programme, which provided the country with technical assistance concerning electricity and gas standards and tariffs, as well as the development of sustainable energy sources.[16]. Armenia has been an INOGATE Partner Country since 1996 and has benefited from 33 of INOGATE's 69 projects.In addition to the IFI resources, the local financial institutions as well have committed a substantial share of resources; which have also been financing energy efficiency investments bundled with usual loans to corporate clients and SME.

This NEEAP assesses the financial resources available in the financial market, their specifics as well as the unmatched investment potential and potential market barriers to recommend financing and other solutions to accelerate EE investments.

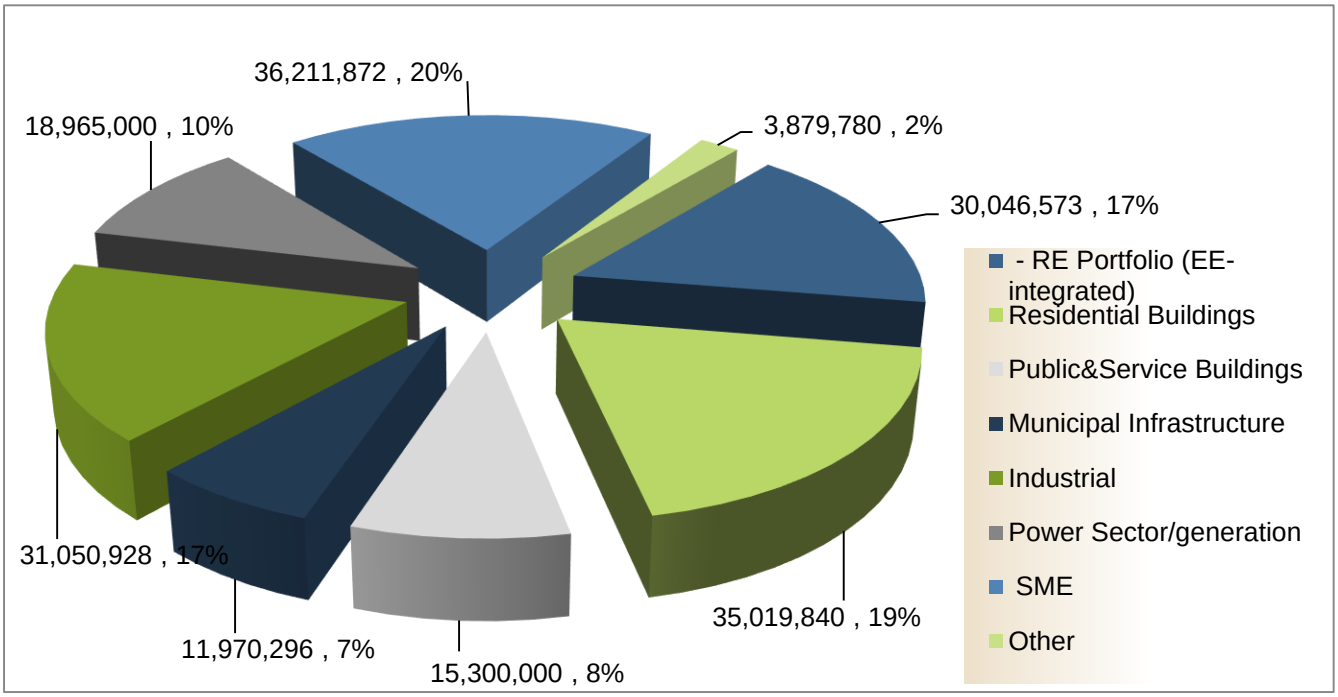


Figure 17. EE/RE PORTFOLIO FOR 2010 - 2020, USD

[15]See http://www.inogate.org/
[16] JOINT STAFF WORKING DOCUMENT Implementation of the European Neighbourhood Policy in Armenia Progress in 2013 and recommendations for action, HIGH REPRESENTATIVE OF THE EUROPEAN UNION FOR FOREIGN AFFAIRS AND SECURITY POLICY, EUROPEAN COMMISSION HIGH REPRESENTATIVE OF THE EUROPEAN UNION FOR FOREIGN AFFAIRS AND SECURITY, Brussels, 27.3.2014

The lending trend for EE and RE investments over the past five years and the provided forecast for future lending is presented in the below figure.

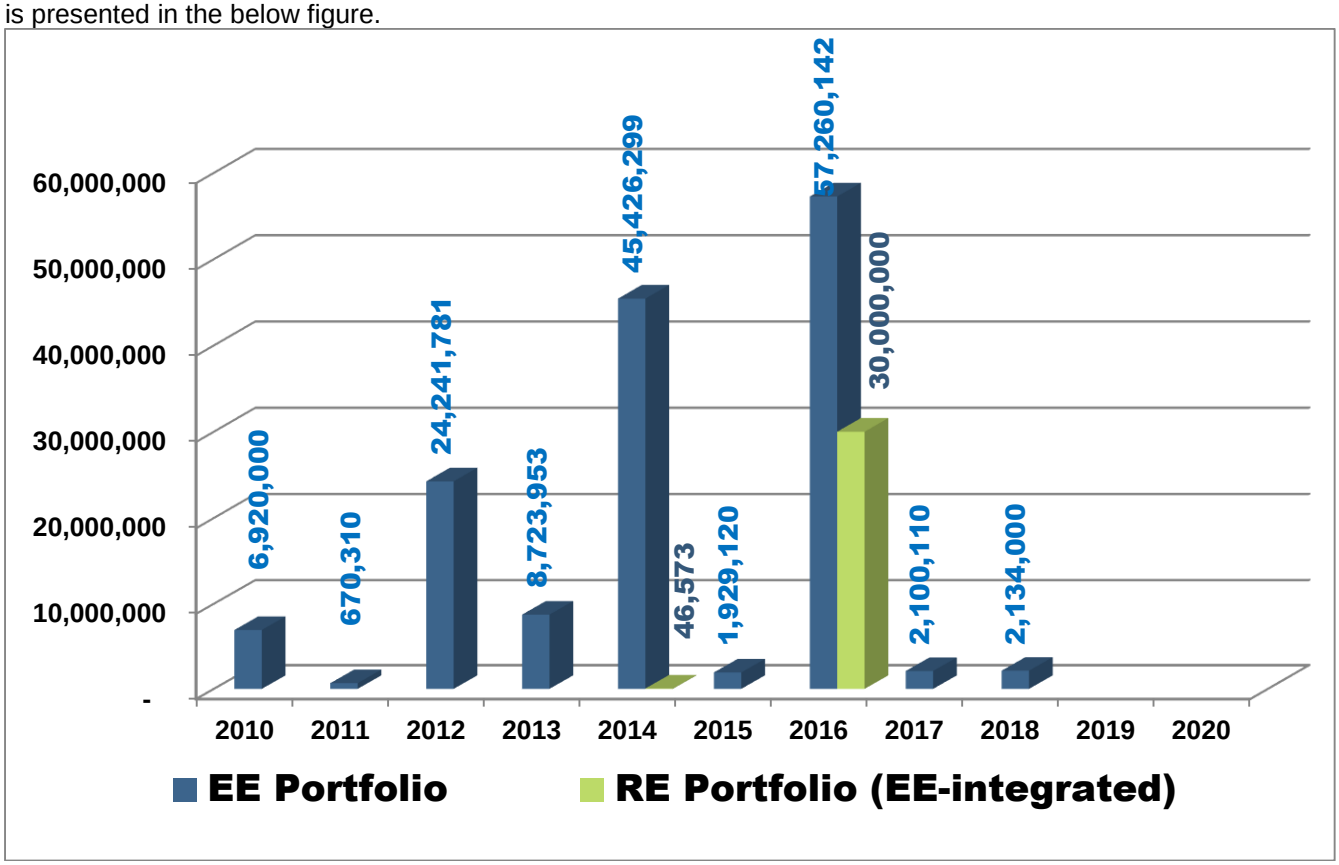


Figure 18. EE / RE PORTFOLIO FOR 2010 - 2020, USD

The analysis of the energy efficiency and sustainable energy investment market, including the IFI reporting indicators has identified recent trends in EE investment field in the Republic of Armenia, revealed the capacity of the market to support planned investments in energy efficiency development until 2020 on annual basis, as well as assessed the uncovered need for investments in energy efficiency to sustain the fastest rate of achievement against energy saving targets.

There are two main sources to finance EE projects :

a) Local Financial Institutions: Banks and Universal Credit Organizations

Total loan portfolio of local financial institutions (LFIs), which includes banks and universal credit organizations (UCOs) increased from $3.026 bln in 2010 to $4.625 bln[17]in 2015, i.e. 8,88% per year. This is about twice more than the GDP growth of Armenia for the same period (recorded at less than 4.65%[18]). The assessed portfolio largest in 2015. Local currency loan portfolio increased 1.59 times,

[17] Information Source: www.cba.am
[18] Information source: IMF World Economic Outlook, 2014

and foreign currency loan portfolio increased 2.27 times in the same period. *The main conclusion is that LFIs prefer loans in foreign currency as a currency risk mitigation tactic.* The total loan portfolio grew from 34% of GDP in 2010 up to 42% of GDP in 2015. Thus, **the total loan portfolio has at least twice growth potential, up to 80-100% of GDPlevel.**[19]
The average loan maturity for loans provided by banks for 2010-2015 registering a slight decline for both local and foreign currency loans.[20] The total amount of loans provided in both local and foreign currency has increased at the same time (see table and figure below). Two major factors impacting this trend were **the lack of long term funds and currency risk**.

Table 15. Main indicators of Banks loan portfolio for 2010-2015

1	**loans provided in local currency**	
1.1	Average maturity	**4.29** (4.38 years in 2010 and 4.17 in 2015)
1.2	Growth of total amount	**11%** (from AMD9.23bln to AMD10.24bln)
2	**loans provided in foreign currency**	
2.1	Average maturity	**4.47** (4.54 in 2010 and 4.12 in 2015)
2.2	Growth of total amount	**83%** (from AMD12.44 bln to AMD22.74 bln)

[19] Cumulative LFI loan portfolio amount of most of developing countries with 4-7% GDP yearly growth is comparable with GDP
[20] Information source: dates provided by Banks

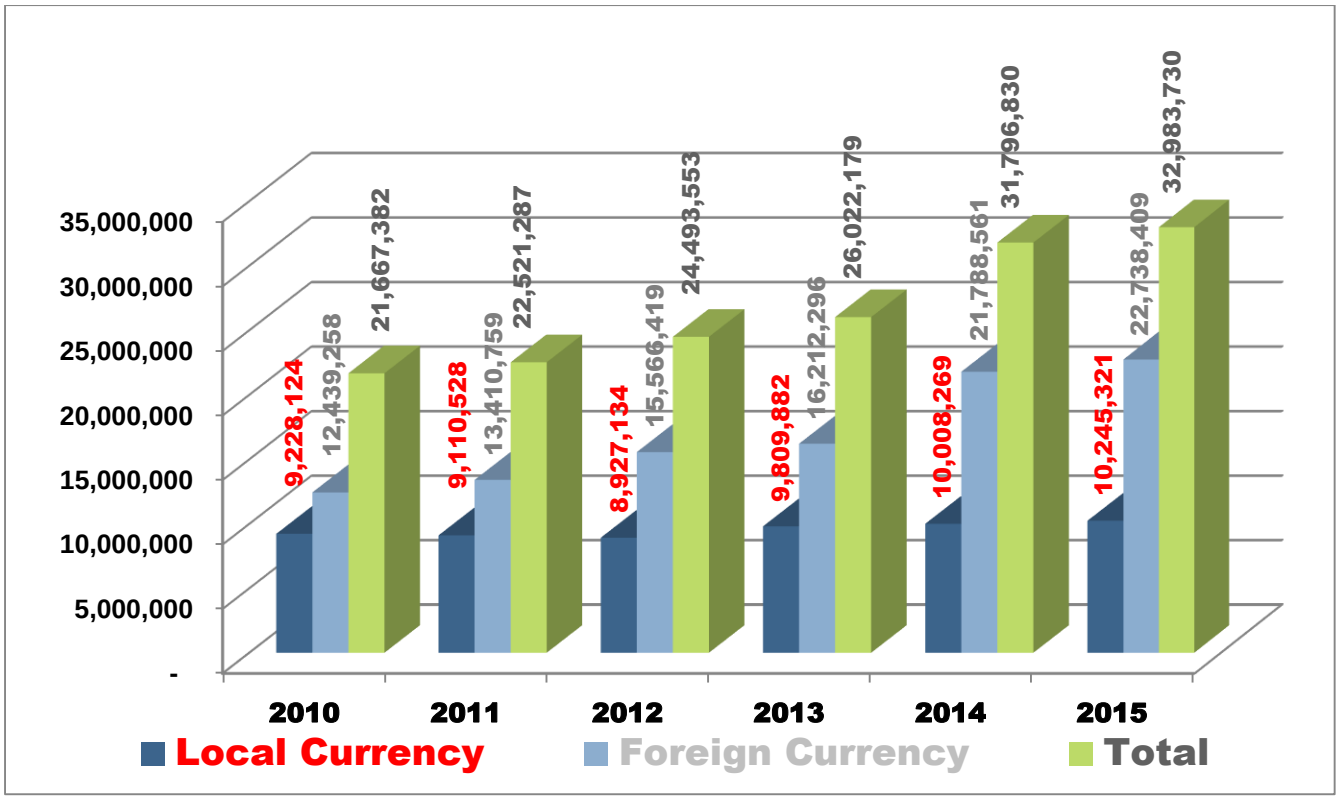


Figure 19. EE / RE LOANS PROVIDED BY LOCAL BANKS IN 2010 - 2015, 1,000 AMD

The average loan maturity for loans provided by UCOs for 2010-2015 registering a slight decline for local currency loans only maturity of foreign currency loans increased.[21] Thus, UCOs prefer to provide short-term loan in local currency and mid-term loans in foreign currency.

	Table 16. Main indicators of UCOs loan portfolio for 2010-2015	
1	**loans provided in local currency**	
1.1	Average maturity	**2.75** (2.91 years in 2010 and 2.72 in 2015)
1.2	Growth of total amount	**99%** (from AMD2.77 bln to AMD5.51 bln)
2	**loans provided in foreign currency**	
2.1	Average maturity	**3.07** (2.91 in 2010 and 3.19 in 2015)
2.2	Growth of total amount	**67%** (from AMD1.03 bln to AMD1.72 bln)

The total amount of loans provided LFIs in local currency has increased by1.33%, and the total amount of loans provided LFIs in foreign currency has increased by over 40%, it means that growth of landing in local currency is about 13 times less than growth of lending in foreign currency. How could this

[21] Information source: dates provided by Union of Credit Organizations of the Republic of Armenia (UCORA)

happen? There are two strong reasons here: A) it conforms that LFIs has not any effective currency risk mitigation tools, experience and capacity, and in lack of these lending in foreign currency is more attractive for LFIs. B) Most of LFIs preferred turn to lending to foreign currency loans when provided refinancing of local currency loans. The main conclusion is that LFIs pay strong attention to currency risk mitigation, and currency risk is a determining factor for EE investments.

The share of EE projects in total loans disbursed by LFIs decreased for loans in both local and foreign currency[22] (see table below).The main conclusion is that EE lending become less attractive for LFIs, plus there is a huge share of loan refinancing, which increased in 2010-2015.

Table 17. Total loans disbursed by LFIs

Indicator	2010	2015	Average share for 2010-2015
Total loans disbursed by local banks			
Loans in local currency	8.60%	5.70%	7.00%
Loans in foreign currency	8.70%	6.40%	7.30%
Total loans disbursed by UCOs			
Loans in local currency	13.00%	7.40%	10.00%
Loans in foreign currency	11.40%	8.30%	9.50%

We can mark two issues for this period: A). Share of refinancing, including IFI loans, increased in 2010-2015. LFIs re-qualify loan from "EE" to "ordinary usually in process of refinancing. B) We can see that drop of loans in Local currency about 1.5-1.8 times faster than in foreign currency. It is obvious that trend to turn to foreign currency lending is not attractive for EE project hosts and developers.

Amount of EE / RE Loans provided by LFIs, including International Financial Institutions' (IFI) funds, increased from $68.74 mln in 2010 to $83.78mln in 2015, i.e. 2.71% per year, which is about 1.72 times less than the annual GDP growth rate. So, Armenia had about $340 mln unutilized EE investment potential in 2010-2015.

The total amount of funds disbursed in EE loans during 2010-2015 as of mid-2015 was $471.14 mln, of which about 81,88% or $385.78 mln disbursed by banks, the remaining 18.12% - by UCOs. At the same time, the share of EE loans disbursed by UCOs increased from 14.92% to 17.97% reaching the largest share in 2012 at about 22.45%. The trend proves that UCOs become one of key players in EE investment In Armenia, especially in short- and medium-term lending. The lending by LFIs and UCOs is presented in Figure 20.

[22] Information source: dates provided by banks and UCORA

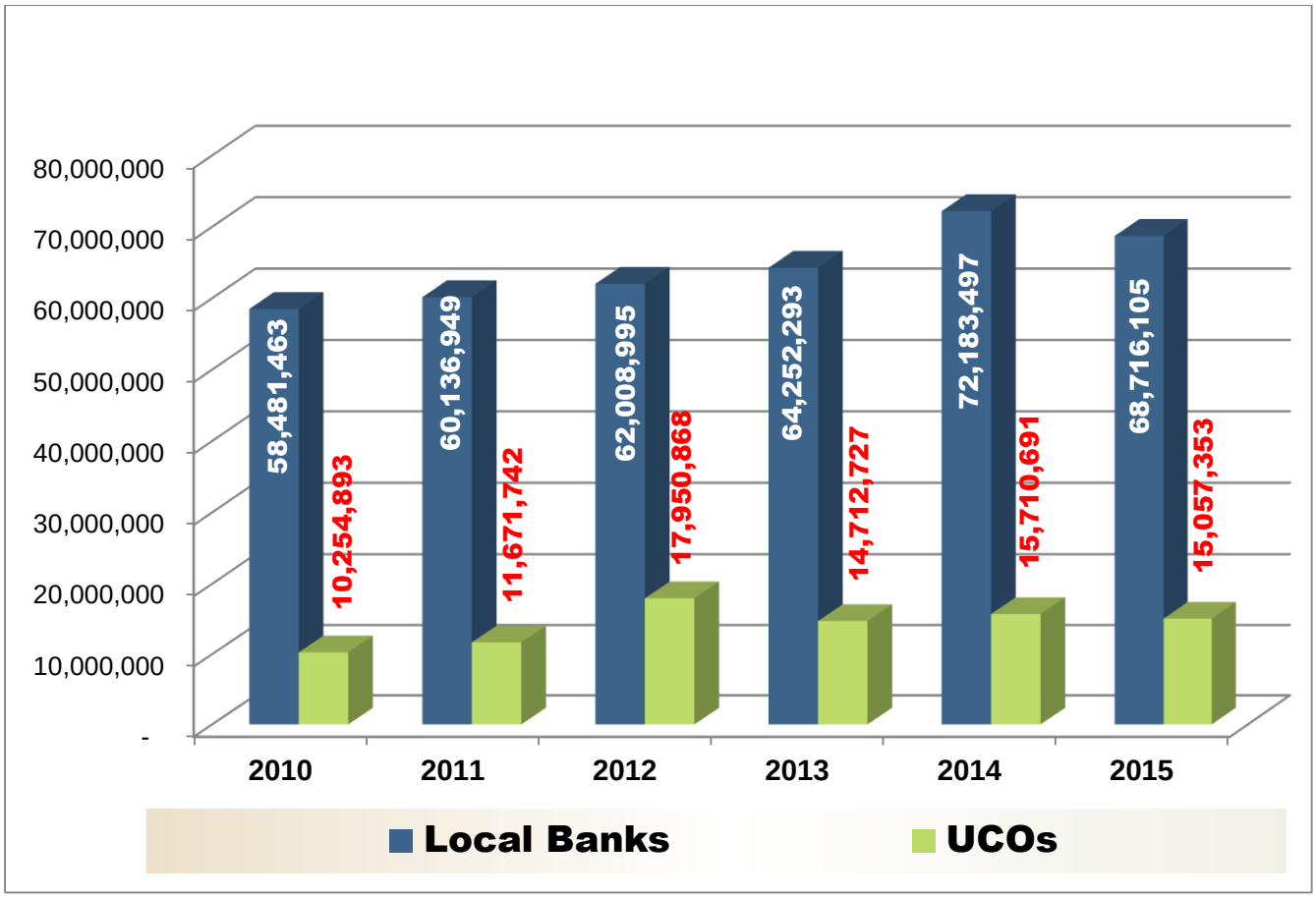


Figure 20. EE / RE LOANS PROVIDED BY LOCAL BANKS and UCOs IN 2010 - 2015 (including IFI funds, USD)

IFI share in total EE investments for 2010-2015 was less than 19%, while the remaining 81% was covered by LFIs from their own sources. **In fact, LFIs are strongly interested in EE lending, and LFIs are the main player in EE financing. (See** Figure 21**)**

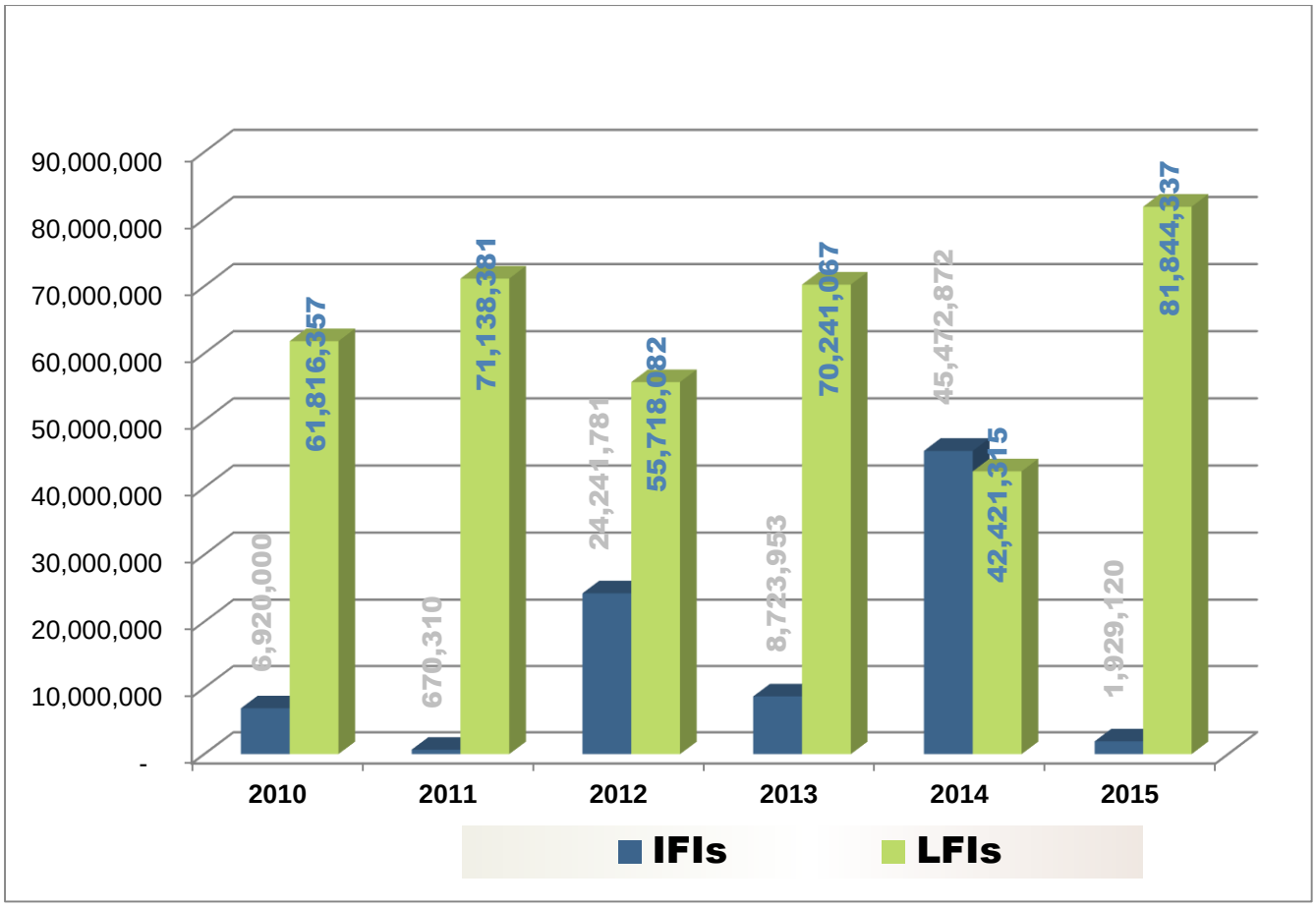


Figure 21. EE / RE LOANS PROVIDED BY LFIs and IFIs IN 2010 - 2015, USD

b) International Financial Institutions[23]

International financial institutions (IFIs) provided more than $87.96 mln EE lending through LFIs, which generated (leveraged)$23.30 mln or more than 26% additional investments/contribution from other sources in EE business in 2010-2015. The biggest lenders were EBRD with total amount of $49.26 mlnand IFC with total amount of $26.57 mln. These two IFIs covered 86% of total loan disbursement by IFIs: 56% EBRD and 30% IFC. Shares of other IFIs were very small, except GGF-about 8% of total amount disbursed. Average weighted interest rate was 10.72%, loan maturity more than 78 months. At

[23] Information source: dates provided by IFIs

the same time average weighted life time of projects/equipment was more than 10 years, i.e. about 1.5 times more than loan maturity.

The most acceptable collaterals were company fixed and current assets, including production facilities, transport and raw materials, own facilities and funds of company shareholders, as well as guaranties from other/third entities.

The biggest portion of EE loans in 2010-2015 were provided to Industry, more than 35%, about 22% to power sector/generation and 18% to small and medium enterprises (SMEs), with transport sector being blended with industry and SMEs as well. About 14% were invested in municipal infrastructure projects. The smallest share of lending went to public buildings - about 0.3%. See the share of energy efficinecy lending in the banks' portfolio visualized in Figure 22.

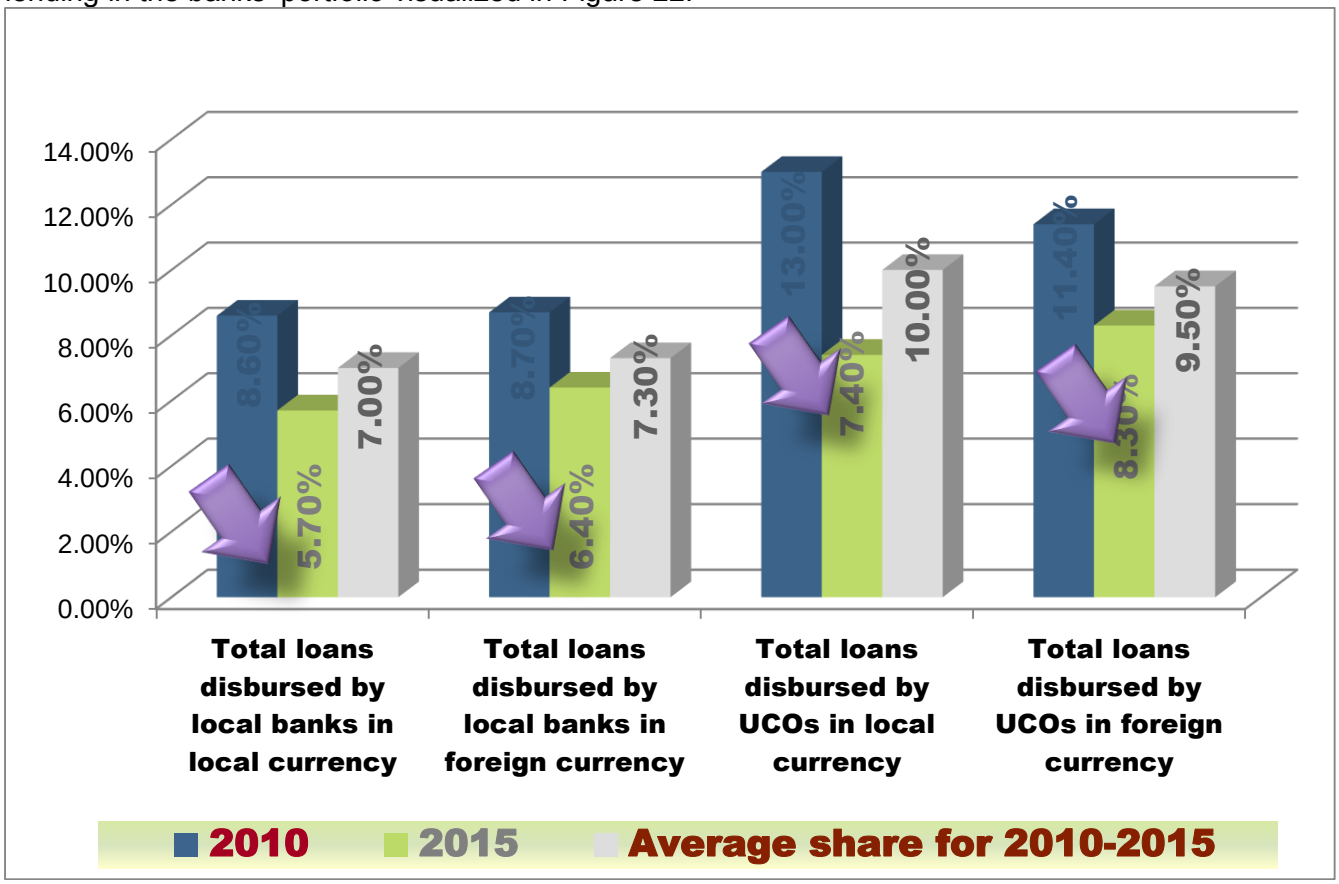


Figure 22. Share of EE projects in total loans disbursed by LFIs in 2010 - 2015, %

The reported volume of lending has yielded total energy saving of1.76 mln MWh for 2010-2015, in with a cumulative impact in 2015 being 4.2 times more in quantity of energy saved than in 2012. Total energy savings estimated for 2010-2020 is 213 mln MWh, with cumulative impact occurring predominantly after 2015. Generally, yearly growth is estimated on a level 96%.
About 150 thousand TOE was saved in 2010-2015, and more than 18.30 mln TOE would be saved in 2016-2020, due to the cumulative effect of savings from past investments. GGF is going to be e main

player in this activity with its estimated share in total savings expected to be about 97.2%. This may potentially be due to the fact, that majority of IFIs has failed to provide reasonable forecast of lending plans beyond 2015.

Capacity Building for Financial Institutions and Supporting the Market for Energy Services

Considering the unserved gap in the energy efficinecy financing demand and the liquidity of the local financial institutions, a comprehensive effort is necessary aimed at building the capacity of the LFIs in the following three directions:

Legislation and regulations

a) EE Invest/lending climate and banking regulation improvement event (ILCIE)

The overall objective of this task is to improve investment policy, banking regulations and normative to make SE financing/lending more feasible for LFIs, IFIs and investors, and attract investments to the sustainable energy sector of Armenia, as well as to promote cooperation among Financial sector, regulatory and policy makers and interested bodies in Armenia through creation of a list of recommendations to submit to Government.

b) Introduction of a compulsory energy audit (label) system for industry

Specific objectives of the combined event are:

to create a roadmap forintroduction of a compulsory energy audit (label) system for industry

to formulate the compulsory energy audit procedures, terms and conditions for big energy consumers

to formulate the compulsory energy audit procedures, terms and conditions for SMEs

c) Improving university curricula in the areas of energy efficiency

The overall objective of this task is to teach new skills in EE to students Armenian technical universities through improving the EE curricula of the beneficiary universities by developing and giving new lectures on following EE subjects: a) EE policy, b) EE economic analysis, c) EE technologies in energy & industrial sector and d) EE tech. in design, const. & operation of buildings.

Capacity building events

d) 2.1 Combined Study tour and Capacity Building Workshop on EE financing

- Specific objectives of the combined event are:
- to equip participants with improved knowledge and skills for making better EE investment decisions
- to transfer to participants EU best practices on EE financing conditions, technologies and methods, including risk management, security activities and monitoring steps, as well as their efficient use
- to improve the capacity of participants to develop and carry out effective and profitable operations with EE project development and implementation
- to promote effective approaches and systems for EE/RES financing, including study of completed loan deals and investment projects, as well as demonstration of working plants constructed through SE financing tools, and projects implemented within the scope of EE financing

e) ***2.2 Capacity building for LFIs on EE financing***

2) The intention is for a West European local banker to teach LFIs how best to conduct business in the EE sphere. It means training bankers, loan officers and investment specialists in EE financing technologies, optimal financing tools, conditions and schemes, project development and feasibility

assessment, as well as to teach how to identify and reduce risks through creation of financing support, guarantee mechanisms and risk management measures

i) 2.3 Industrial Energy Audit Analysis for Bankable Projects for Energy Engineers and ESCOs

This event is targeted to equip local engineers with adequate tools and methodologies to assess the financial and economic viability of EE projects. This capacity building workshop teaches energy engineers and energy managers to understand and speak management's language, improves their capacity in using tools and methodologies in preparation of their EE project, and the crucial parts of the process of how to prepare EE projects that can be submitted for financing, and present projects in relevant economic terms.

ii) 2.4 Capacity building for LFIs on Energy Audit

3) Specific objectives of the event are:
4) to improve the capacity of participants to carry out effective energy audit through using new methodologies, tools and advanced technologies
5) to transfer to participants EU best practices on energy audit,
6) to transfer to participants package of documents to provide energy audit services, including typical forms and templates
7) to present participants energy audit legal framework, and the main factors and milestones which formulate energy audit market in Armenia

i) 2.5 Capacity building for LFIs and ESCOs on performance contracting

8) Specific objectives of the combined event are:
9) to equip participants with improved knowledge and skills for making better EE business decisions
10) to transfer to participants main principals, topics, terms and forms of performance contracting, as well as legal, regulatory and normative framework EE business,
11) to transfer to participants package of documents for performance contracting for EE business, including typical forms and templates
12) to transfer to participants EU best practices on EE business terms, technologies and methods, including risk management, security activities and monitoring steps, as well as their efficient use

13) <u>Awareness raising</u>

a) 3.1 Development of online information portal on EE Business

b) Establishment of a web portal of all energy efficiency product and service vendors, financiers, consults, governmental and non-governmental institutions as well as basic portfolio of awareness materials on energy efficiency, technical and financial solutions.

c) Establishing and operating a EE business information centre

14) Promote EE policy by engaging policy makers in events that are highlighting particular problems that needs to be addressed through legislation or regulation
15) Provide EE public and information actions
16) Develop EE information materials and work with general public, especially students and children, as well officials, business entities, IFIs and NGOs.

a) Combined Study tour and Capacity Building Workshop on EE Awareness Raising

17) The main goal of this event is to raise awareness of EE in Armenia through enhancing capacities of the participants to design and implement effective awareness raising activities in EE, as well as capacity building among participants to create and operate awareness raising and information centre and implement awareness raising activities for various groups. Expected results will be: a) improved professional skills to design and conduct effective information campaigns and awareness raising activities to promote SE among a broad range of groups; b) increased awareness of these professionals on the need, importance, and benefits of adequate awareness raising efforts; c) enhanced networking among peers in EE

3.2.2 Promotion of the Covenant of Mayors

A process which has initiated after the first NEEAP development was the Covenant of Mayors East Movement. It is a horizontal measure with regards to the cross-sectoral nature, local policy and planning elements, as well as emerging synergies with the national and international policies and progams, as well as financial measures. Implementation of CoM in Armenia is facilitated by respective supporting structures including the Ministry of Energy and Natural Resources of RA, acting as the Covenant Coordinator in Armenia, as well as by Union of Communities of Armenia and Energy Saving Foundation, acting as the Covenant Supporters in Armenia. Coordinators are defined as those entities that are in a position to provide strategic guidance, technical and financial support to municipalities with the political will to sign up to the Covenant of Mayors, but lacking the skills and /or resources to fulfill its requirements, namely the preparation and implementation of Sustainable Energy Action Plan. Supporters are national, regional and local networks and associations of local and regional authorities which leverage their

lobbying, communication and networking activities to promote the Covenant of Mayors initiative and support the commitments of their signatories.
As of 01.07.2015 there are 10 signatories of the Covenant of mayors in Armenia. List of signatories with completed SEAPs and SEAPs under development is presented in the table below.

Table 18. Information on SEAPs of the Covenant signatories in Armenia

Item	Signatories					
	Tsaghkadzor	**Vayk**	**Spitak**	**Hrazdan**	**Aparan**	**Artik**
Date of adhesion	09.06.2009	22.05.2014	13.05.2014	21.05.2013	02.09.2013	20.06.2014
Completeness of SEAPs as of 01.07.2015	100%	100%	100%	100%	90%	50%
Date of SEAP approval by municipal councils	24.10.2014	02.03.2015	10.04.2015	09.06.2015		
Baseline year for BEI	2011	2011	2011	2012	2012	2012
Population in baseline year	1750	6724	16883	53525	7387	19600
GHG emissions in baseline year	2235,9	7515,64	8953,24	26399,23	3091,13	
Fixed year or BAU	Fixed year	Fixed year	BAU	BAU	BAU	
GHG emission reduction commitment by 2020	447,2	1776,95	2294,24	6617,0	776,4	
Total investment needed for implementation of SEAP, thousand Euro	1214,0	1344,4	1949,3	5239,8	658,8*)	
Per capita investment for SEAP implementation, Euro/person	693,7	200,0	115,5	97,9	89,1*)	

***) Preliminaryinformation**

Except for Tsaghkadzor per capita investments for SEAP implementation varies from 100 to 200 Euro per person. For Tsaghkadzor this value considerably differs not only because of very small size of the community but also because consideration of transport streams (including intercity traffic through the territory of the community) in the Baseline Emission Inventory (BEI) of that signatory. For other communities that component of BEI is usually not considered because influence of the local authorities on that sector is very limited.

As of 01.07.2015 there are four SEAPs approved by the municipal councils of the signatories and two plans for Aparan and Artik are under development. For estimation of ecological efficiency of the proposed energy saving and GHG emission reduction measures a concept of sectorial capital intensity (i.e. investments needed to reach one tone of CO2 emission reduction

per year) of measures is applied. Sectorial capital intensity of measures proposed in SEAPs are represented in the below table.

Table 19. Sectorial capital intensity of SEAP measures

Sector	Capital intensity of measures, Euro / tCO_2 year					
	Tsaghkadzor	Vayk	Spitak	Hrazdan	Aparan	Artik
Municipal budget *	2235	3472	5430	823	1962	
Residential sector	3779	705	664	795	384	
Renewable energy	2281	2202	2182	1628	1884	
Transport		140		83		
Awareness raising	1085	241	523	84	343	
CO_2 absorptions		90	368	271	327	
Total	**2714**	**754**	**850**	**792**	**848**	

***) Including municipal street lighting**

As it is seen for the above table, except for Tsaghkadzor, capital intensities for the municipalities do not differ sizably. Average value can be estimates at about 800 Euro / tCO_2 year. The biggest investments are needed for budgetary and RE sectors. Most effective investments seem to be in residential sector. The capital intensity value for this sector is quite close to the total value which is explained by big weight of this sector in overall balance of GHG emission reduction sometimes reaching up to 80% (e.g. for Spitak).

Key measures proposed for implementation in residential and public buildings are as follows:

- ✓ Thermal insulation of building envelopes;
- ✓ Replacement of roof coats with galvanized iron plates or new coating materials;
- ✓ Application of thermal insulation materials (15-20 cm thickness) on ceilings of last floors of the buildings with balks;
- ✓ Replacement of wooden windows with new energy efficient ones;
- ✓ Replacement of entrance doors of multi apartment buildings;
- ✓ Replacement of inefficient incandescent lamps with energy efficient lighting, etc.

Also the following so-called low-cost measured aimed to save heat in premises are envisaged in the buildings:

- ✓ Insulation of windows and doors with application of silicone, foam rubber, sealants, polyvinylchloride and foam plastic;
- ✓ Installation of door closers;
- ✓ Installation of heat reflecting screens behind radiators;
- ✓ Construction of tambours;
- ✓ Heat insulation of internal heat distribution networks in basements and attics, etc.

Key measures proposed in transport sector are introduced below:

- ✓ Introduction of bikeways;
- ✓ Shift to natural gas as a fuel for municipal and public transport.

In the renewable energy sector the following measures are proposed:

- ✓ Installation of individual (apartment level) solar water heaters;
- ✓ Installation of solar water heaters for collective use for hot water supply and pools;
- ✓ Installation of PV modules for electricity generation for illumination of entrances and yards of multi apartment buildings.

Utilization of other types of RE sources on the territories of the target municipalities is not promising and, hence, is not considered in the SEAPs. From energy and ecological efficiency standpoints renewable energy is relatively "expensive" option (see table 2).

Measures proposed for awareness raising of population and enterprises are summarized below:

- ✓ Organizationof "EarthHours"
- ✓ Organization of Energy Days;
- ✓ Application of energy certificates for buildings;
- ✓ Involvement of pupils of schools into energy development of municipalities
- ✓ Introduction of optional subjects on energy saving and renewable energy in schools, etc.

Energy efficiency of proposed measures

In the table 3 below energy efficiencies of the measures proposed in the SEAPs are summarized.

Table 20. Energy efficiency of SEAP measures

Sector	Unit	Energy efficiency of measures in SEAPs				
		Tsaghkadzor	Vayk	Spitak	Hrazdan	Aparan
Municipal sector *	MWh/year	435,9	313,3	157,3	4303,8	500,4
	%	17,6	4,2	1,6	15,2	15,6
Residential	MWh/year	847,0	5065,0	7967,9	19682,5	2047,7
	%	34,2	68,1	82,9	69,4	63,8
Renewable energy	MWh/year	651,0	346,8	817,2	1909,7	513,9
	%	26,3	4,7	8,5	6,7	16,0
Transport	MWh/year	-	1483,1	-	1168,8	-
	%	-	19,9	-	4,1	-
Awareness raising	MWh/year	541,2	227,2	669,8	1286,0	147,2
	%	21,9	3,1	7,0	4,5	4,6
Total	**MWh/year**	**2475,1**	**7435,4**	**9612,3**	**28350,8**	**3209,2**

***) Including municipal street lighting**

The biggest relative efficiency is ensured by residential sector which requires that most of the investments. In the considered SEAPs contribution of residential sector in reduction of energy consumption varies from 34% to 83%. The longer the heating season is the more efficient

investments in heat insulation of buildings are. From that point of view Aparan is in better position because of 212 day long heating season.

Residential sector has the largest potential for energy efficiency because the vast majority of infrastructure is old and has low thermal insulation capacities. However, for identification of optimal and economically justified level of heat proofing features of the infrastructure it is required to carry out a separate and more detailed study with consideration of the existing and perspective heat insulation materials market.

In the transport sector shift from petrol to natural gas for passenger cars is definitely justified from economic and ecological points of view. However, GHG emission reduction effect of this measure is limited because difference between emission coefficient of petrol (0,249 tCO_2/MWh) and that of natural gas (0,202 tCO_2/MWh) are quite close (taking into consideration energy values of both fuels). Nevertheless, transition from petrol to natural gas in the privet transport sector is ongoing intensively and has positive influence.

In renewable energy sector only solar energy plays a vital role in the provided SEAPs. Contribution of this source of renewable energy in increase of power consumption efficiency varies from 55 to 25%. Capital intensity of measures with utilization of solar energy is quite stable (1800 – 2200 Euro/tCO_2 year).

Table 21. Efficiency of measures in solar energy sector within CoM SEAPs

Parameter	Unit	Signatories with developed SEAPs				
		Tsaghkadzor	Vayk	Spitak	Hrazdan	Aparan *
Investments till 2020	1000 Euro	300,0	181,5	422,0	728,0	228,4
Power generation	MWh/year	0	0	40,0	430,3	58,5
Heat power generation	MWh/year	651,0	346,8	777,2	1479,4	455,4
GHG emission reduction CO_2	t/year	131,5	82,4	193,4	447,1	121,2
Share of energy saving from solar technologies in the total energy saving proposed in SEAP	%	33,17	4,66	8,50	6,74	16,01
Share of GHG emission reduction from solar technologies in the total GHG emission reduction proposed in SEAP	%	29,41	4,62	8,43	6,76	15,61

***) For Aparan all data are preliminary**

Baseline years selected by all considered municipalities are different from years of SEAP development (earlier years are selected) as it can be seen from the table 1. As a result some part of measures described in SEAPs have already been implemented within the period from the selected baseline years to the years of SEAP development. Hence, it makes sense to consider also that period of time (i.e. before 2015). For Tsaghkador, Vayk and Spitak

implementation of measures starts from 2012, whereas for Hrazdan, Aparan and Artik from 2013.

Realization of the majority of proposed measures require more than on-year period. Given that at this stage there are no exact time and work schedules for realization of the measures, annual distribution (breakdown) of investments needed for realization of the proposed measures is made evenly.

Dynamics of annual investments for already realized and planned SEAP activities are represented in theTable 22. Information in the table is given for respective sector for 5 municipalities up to 2020. It is likely that this number will grow, but no data is available to assess the dynamics. The consecutive NEEAP(s) will need to assess this impact.

For purely analytic purposes, the full range of various financing programs is summarized in the Table 22 to show the overall impact of various donor and IFI efforts and the full scope of the EE financing measures in a single table. The EE financing programs from the below table without cross-cutting/horizontal impact are evaluated as part of their respective sectoral EE improvement measures.

Table 22. Summary of All EE financing Facilities and Programs, and their Assessed Impact

No	Title of the energy saving measure	End-use targeted	Duration	Achieved energy savings in 2014 toe	Achieved energy savings in 2017 toe	Achieved energy savings in 2018 toe	Achieved energy savings in 2020 toe	Status in relation to 1st EEAP
R.1	Financing for Energy Efficiency: Implementation of energy saving activities in municipal and social public facilities (R2E2/GEF/WB)	Social and public facilities	Start: 2012 End: 2017	401	4,006	5,609	8,814	partially completed
R.2	New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2016 End: 2020 (ongoing)	-	11,442	14,653	21,037	partially completed
R.3	Legal Support, Financing and Information: Improvement of Energy Efficiency in Buildings; development of secondary legislation for EE in buildings, as well as funding for the first pilot thermal modernization of a residential multi-apartment building in Avan district of Yerevan and social housing in Goris and Akhouryan towns	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2013; End: 2017	1,200	1,200	1,200	1,200	partially completed

R.4	Financing for EE & Public Procurement for EE: UNDP Green Urban Lighting Project GHG Emission reduction by increasing energy efficiency of municipal lighting in the cities of Armenia	Municipal lighting electricity use in the cities of Armenia	Start:2013 End: 2017		47	47	47	partially completed
R.5	Financing for Energy Efficiency: GGF	EE and RE solutions for households space heat and lighting efficiency (windows, doors,heat supply, lighting, distribution systems) and SMEs		35,069	841,656	361,847	176,747,728	partially completed
R.6	Financing for Energy Efficiency: KfW EE loans for households and SMEs	residential energy end-use, SME EE of production processes, space heat conservation	Start:2009 End: 2015	3,078	12,310	15,388	24,620	partially completed
R.7	Financing for Energy Efficiency: Household energy efficiency loans and EE mortgage loans (NMC/AFD)	Household EE loans and EE mortgage loans ; residential buildings and private homes' space heating, hot water preparation	Start:2014 End: 2020	-	141	164	211	partially completed
R.8	Financing for Energy Efficiency: Energy efficiency loans for residential and business clients, EBRD ArmSEFF	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)	Start:2006 End: 2015	341,655	341,655	341,655	341,655	partially completed
R.9	Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	residential energy end-use in space heating and hot-water preparation	Start: 2013; End: 2018	30	4,914	5,067	5,067	partially completed

R.10	Financing for Energy Efficiency: Eastern European Energy Efficiency and Environment Partnership (E5P)	faclitation of energy efficiency finance in municipal infrasturcture with grant co-financing	Start: 2015 End: ongoing	-	-	-	-	partially completed
R.11	Financing for Energy Efficiency & Public Procurement for EE: EE-integrated reinforcement of Schools by KfW	Public & service buildings (schools)	Start:2016 End: 2020	none, new measure	39,897	39,897	39,897	partially completed
R.12	Financing for Energy Efficiency: KfW Housing EE credit line	Residential energy end use, heating, hot water preparation, lighting	Start:2016 End: 2020	new measure	The exact EE savings depend on the specific measures which will be financed through the subloans.	Appropriate indicators and energy saving forecast will be provided as soon as the project concept is fully developed.	0	partially completed
R.13	Financing for Energy Efficiency: KfW EE loans for SMEs - EE credit line	Commercial energy end use, heating, hot water preparation, lighting, process heat, etc	Start:2016 End: 2020	new measure	The exact EE savings depend on the specific measures which will be financed through the subloans.	Appropriate indicators and energy saving forecast will be provided as soon as the project concept is fully developed.	0	partially completed

R.14	Mitigating Tariff Increase with Low-income Energy Efficiency Program	Residential energy end use, lighting efficiency	Start: 2015; End: 2016		40,531	58,545	94,573	new measure
Sum of savings:				381,431.78	1,297,798.45	844,070.60	177,284,847.82	

4 ALL INDIVIDUAL MEASURES

4.1 Buildings Sector

The overall buildings sector in the NEEAP is split between several sections, according to the NEEAP methodology and template. The overall energy efficiency policy reform, regulatory processes and developments are reported in the cross-cutting/horizontal elements, the investments in existing residential buildings and regulations for new construction are covered in the Residential Buildings section (titled ”Buildings”).

The public buildings, grouped with services sector, are presented in Public and Private Services. Of overall 80 million km^2 of the nation-wide building stock, 83% are residential buildings, and the remaining 17% - public buildings.

Both the residential and public building stocks are projected to grow, but the residential sector is going to be responsible for most of this growth (Figure 23).

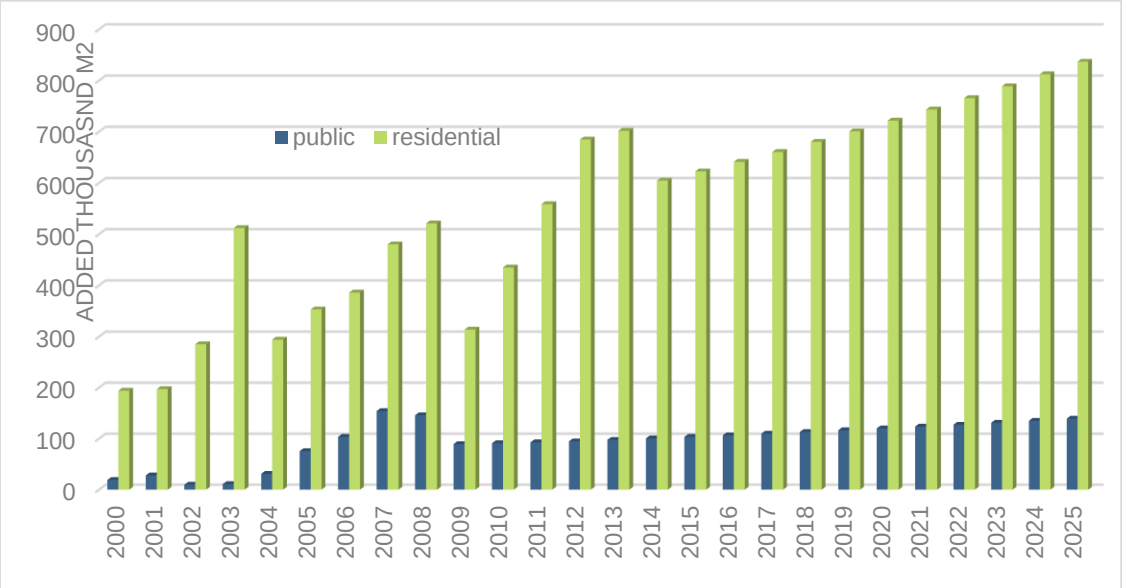


Figure 23. Growth dynamics and forecast for residential and public building stock in Armenia

The buildings have been responsible for 34-40% of national energy use during 2010-2012. This

share has been declining and is expected to fall further in the next 15 years. See Figure 24.

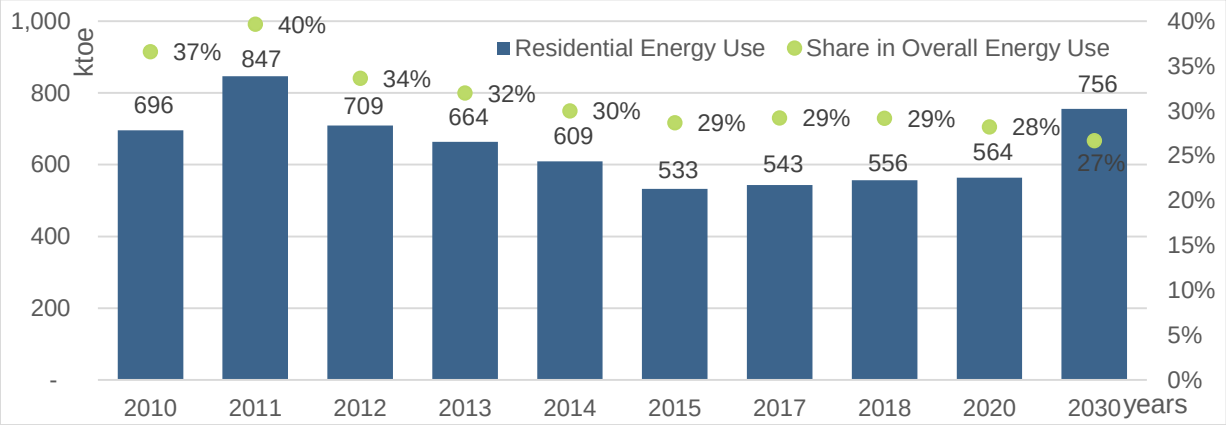


Figure 24. Energy Use in Residential Sector, 2010-2030.

Source: EC-LEDS Energy Balance for 2010-2012, authors' own calculations for 2013-14, MARKAL model projections beyond.

4.1.1 Regulatory Measures

The energy consumption has been decreasing in the buildings sector over the past 5 years. There is a vivid adverse correlation between the growing energy prices and the residential energy end use. Hence, it can be presumed that the shrinking energy demand is likely a consequence of

deteriorating energy affordability (See Figure 25).

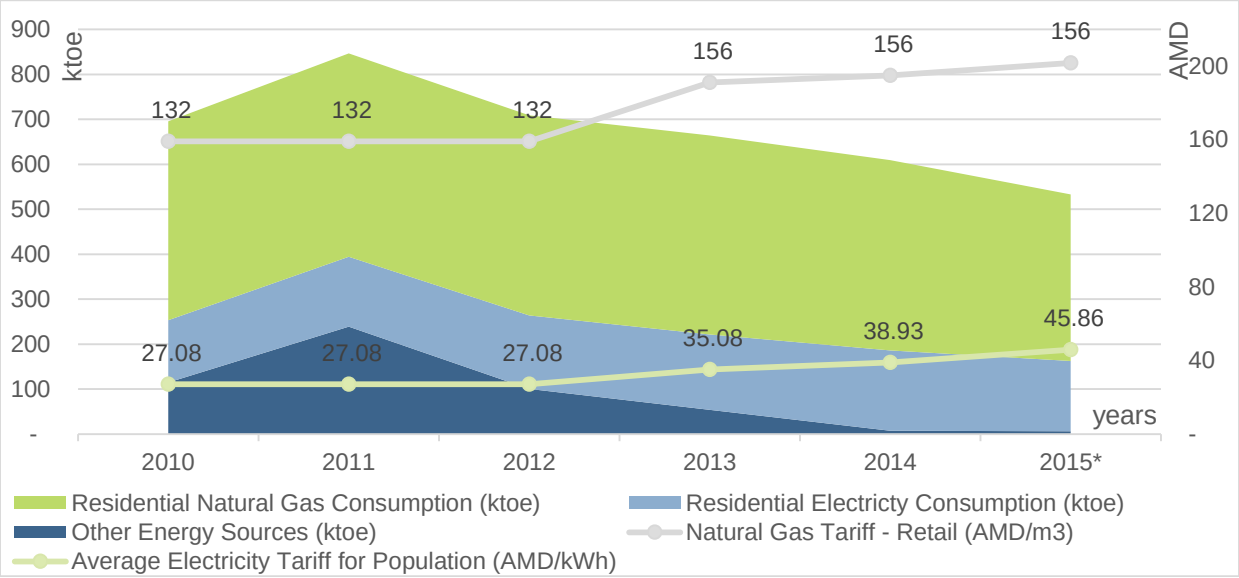


Figure 25. Energy tariffs and Energy Consumption in Residential Sector, 2010-2015

** - the 2015 tariffs for electricity have been announced by the PSRC, but not effectively enforced due to public protests. The President of RoA announced a temporary freeze on the tariff while an audit investigation assesses the grounds for the proposed tariff hike. In the meantime, the Government will shoulder the difference subsidizing the tariff. The review was not completed by the time of delivery of the present document.*
** - data on other sources was not available beyond 2013.*

The 2013 WB Power Sector Tariff Study for Armenia has analyzed the affordability of current and expected energy tariffs under various scenarios. The recent energy price hikes have enhanced energy poverty of low-income households (13% of household disposable income spent on energy costs[24]). To cover the suppressed demand for electricity and natural gas, the population has increased consumption of wood for heating purposes. Wood consumption throughout the country has increased from 20% of primary energy sources to 30% in 2012. In rural communities this share has reached 62% in 2012. In the absence of the 2011 subsidy for the recipients of the national poverty benefit plan this situation would have been worse.

The current tariff structures need to be reviewed and revised to introduce built-in incentives for energy efficiency and conservation, while providing the minimal consumption block to the low-income households at an affordable tariff. The regulatory reform should be supplemented with support for energy efficiency as the best way to sustainably reduce the energy demand in the long run. The next section further analyzes the tariff regulatory framework for electricity and

[24] Internationally accepted threshold for energy poverty being 10% of household's disposable income.

natural gas.

Electricity Tariff

Electricity tariffs for the end users are one-part and are defined based on voltage and time zones (time-differentiated tariffs). Difference between tariffs in two time zones may be within about 30%. Hence, electricity tariffs indirectly depend on consumer groups i.e. large consumers that are fed from high voltage substations enjoy lower tariffs then those that are fed from relatively lower voltage distribution system (see Table 23).

Table 23 Electricity tariffs for final customers (in national currency)

Type of consumer	AMD/kWh Since 1 August 2014	AMD/kWh Since 1 August 2015
For private households, day	41.85	48.78
For private households, night	31.85	
For industry 6 (10) kV, day	38.85	
For industry 6 (10) kV, night	28.85	
For industry 35 & 110 kV, day	32.85	
For industry 35 & 110 kV, night	28.85	
For public sector, day/night	41.85/31.85	48.78/
For commercial sector, d/n	41.85/31.85	48.78/

Source: PSRC, June 2015

EE for Low Income Households

On June 7 the PSRC announced a new expected increase in the electricity tariff within 2 years from the last time the tariff has increased. This increase will step in as of August 1, 2015, which triggered major social unrest, followed up by a promised by the Government to shoulder the burden of the tariff increase with extra-budgetary sources, while the justifications for tariff increase are being scrutinized through an audit of the utility. To cope with the latest proposed increased of the tariff for the population, in the buildings sector the second NEEAP proposes a low-income efficient lighting program. To remedy the impact of tariff increase, the Government must offer energy efficiency solutions to the low-income households, as opposed to the traditional subsidies. Mitigating impact of electricity tariff increase on low-income households can be done by offering subsidized efficient (LED light bulbs) to replace incandescent light-bulbs in 225,000 households (32% of population categorized as below the poverty line). A respective measure is included in the Financing section.

Gas Tariff

Due to the increase of the natural gas import prices electricity tariffs for final customers have been raised several times. Tariffs are also set for the natural gas transmission and distribution companies as well as for the operator of gas supply system and retail supply. One-part tariffs are set for natural gas end users and the tariffs depend on a monthly consumption volume. For different consumers groups the PRSC sets tariffs in different currencies. For large consumers (which consume about 75% of all imported natural gas) the tariff is set in USD to mitigate the currency exchange rate risk for Gazprom-Armenia (the gas importing company).

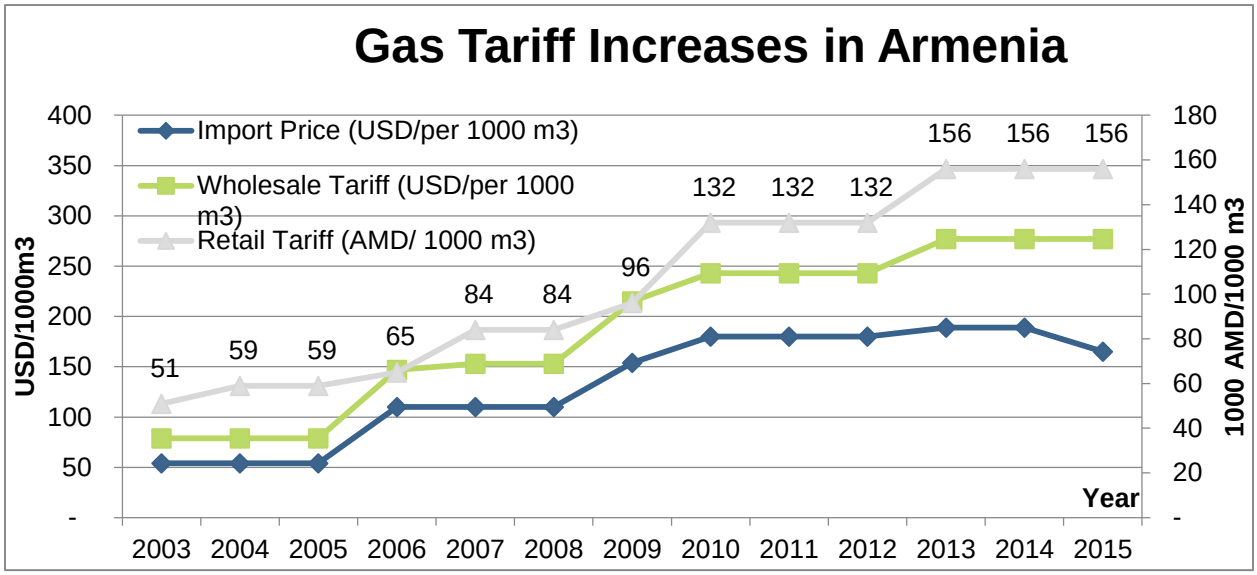


Figure 26. Natural gas import price and tariffs for two different final customer groups (2003-2015)*

Tariffs for the large customers were 38% lower in 2013 than tariffs set for the smaller consumers (consuming less than 10,000m^3 per month). Servicing large consumers indeed creates lower costs. However, such a considerable difference between the tariffs for these two customer groups leads to forced increase of the monthly gas consumption by customers whose monthly consumption is close but still below 10,000 m^3 threshold in order to save money by being billed the wholesale tariff. This happens for building level heating systems and SMEs.[25] In order to stop incentivizing waste, and instead incentivizing energy efficiency measures, this perverse tariff incentive must be removed. Certain types of gas consumers must automatically qualify for the wholesale tariff. These include autonomous heating systems, SMEs, small-scale service vendors (cafes, restaurants, hotels, laundries, etc.) and other consumers who on average consume over 7000 m^3 per month. In addition, the difference between the wholesale and retail tariffs should be narrowed to eliminate incentive to calibrate consumption to take advantage of the lower tariff, while stopping the cross subsidy of the industrial consumers by the

[25] Since many years there has been a discussion about the need to apply the whole-sale tariff for centralized heating systems, but this discussion did not lead to any results.

population.

Table 24. RA Natural Gas Supply and Payments, As of 2014

N	Natural Gas Consumer Groups	Number of Consumers	Volume of Supplied Natural Gas in Distribution System (mln. m3)	Product Delivery (mln. AMD)	Inflow of Financial Means (mln. AMD)
1	Consumers with <6,000 m3 monthly consumption	665.633	574.6	89120.7	90657.7
2	Consumers with 6-8,000 m3 monthly consumption	101	8.3	1285.6	1236.7
3	Consumers with 8-9,000 m3 monthly consumption	22	2.2	347.9	337.5
4	Consumers with 9-10,000 m3 monthly consumption	14	1.5	237.2	231.5
5	Consumers with 10-13,000 m3 monthly consumption	214	28.1	3214.2	2972.5
6	Consumers with >=13,000 m3 monthly consumption	653	1394	134727	125430.8
	Total		2008.8	228932.6	220866.8

Considering that in most cases the customers consuming in the group between 10,000m3 and 13,000m3 are likely to choose this high level of consumption intentionally to qualify for the lower tariff (which explains the dramatically small number of consumers in categories between 8,000-10,000m^3 monthly), it is recommended to revise tariff structure. A reform is necessary to remove perverse tariff incentives that are accelerating unnecessary gas consumption by public facilities and commercial establishments, SMEs and decentralized small-scale, building-level heating systems. A new tariff structure is necessary to make a transition to an increasing block rate system, which is the internationally recognized best solution for a tariff system, which not only has incentives for conservation, but also a built-in social safety net, allowing the all the lowest income groups (not just the recipients of the poverty benefit plan, which have been paying 100AMD/m^3 since 2011 for the first 300m^3 as social assistance measure supported by the Government) to receive the minimal level of gas for the lowest possible price, while excessive use is penalized by

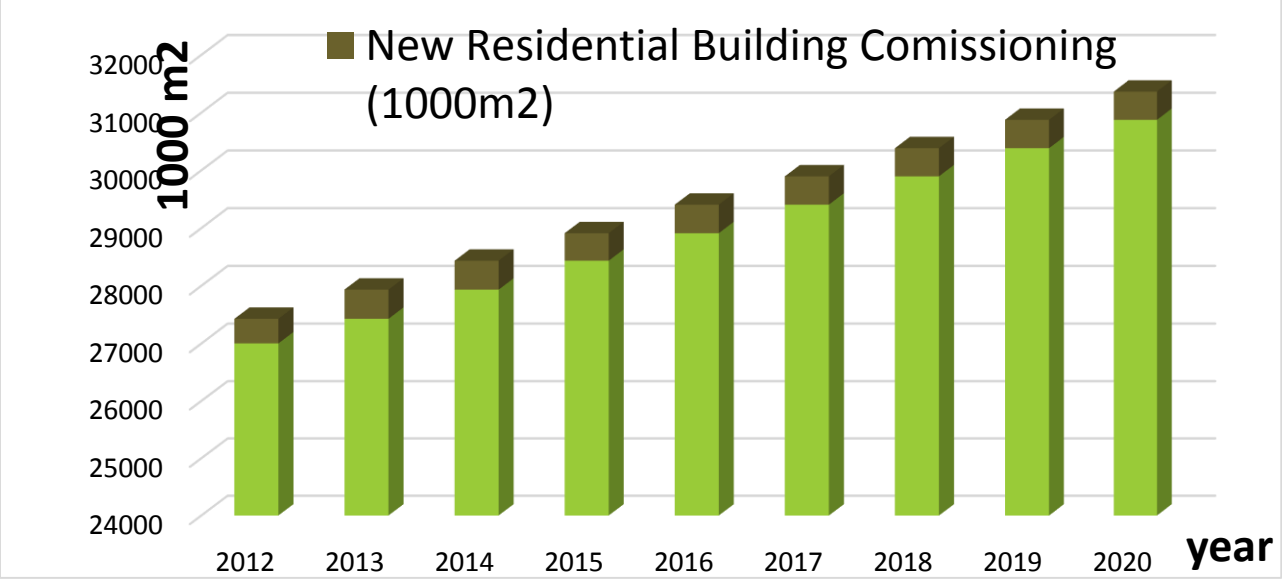
a higher block rate.

Technical Regulations for Building Energy Performance

The energy efficiency issues of the buildings sector are related with the poor energy performance of the building envelopes in both residential and public buildings, inefficiencies of internal energy infrastructures (heating, lighting, hot water, and cooling systems), as well as the poor behavioral practices in energy management. For the new construction, the main issues are the overarching failure to comply with the building codes regulating building thermal protection and general energy performance, as well as overall law technical capacity of the professionals in the construction sector to design and construct energy efficient buildings.

4.1.2 New Construction

Housing construction was one of the driving forces of the economic boom in Armenia (26% of GDP) until 2008 financial crisis. But the number of completed dwellings remained low, and the construction sector started slowly recovering in 2012.



Similarly, the INOGATE Energy Saving Initiative in Buildings provided support with integrated building design for a social housing project in Dilijan, which reduced the energy demand of the proposed building from estimated 260kWh/m2 per year to 160 kWh/m2 per year with the use of optimized building design, passive solar gains, improved shape coefficient, and extensive use of insulation.

The 1995 construction code on “Thermal Protection of Buildings” has had very poor enforcement from its adoption, it was never revisited to adapt to the new construction technologies and materials, neither has it been integrated into the context of Armenia’s international cooperation

in the field of building energy performance regulation. These processes included the CIS Interstate Construction Norms development and harmonization, as well as approximation attempts of Armenia with the European Union's Directives, including the Energy Performance in Buildings Directive, within the Eastern Neighborhood Partnership Initiative (ENPI).

The Ministry of Urban Development (MUD) is the key state institution responsible for the regulatory framework on building energy performance. In 2013 the bylaws of the MUD were updated (Governmental Decree N225-N) to add requirement to ensure energyefficiency and energy saving in the sector.

For Armenia it is an issue of major importance with respect to its energy security, economic stability, social and environmental protection and the Government of the Republic of Armenia has regularly emphasized the importance it attaches to energy efficiency improvement both in existing and newly constructed buildings.

Moreover, most of the investments in energy efficiency in buildings have positive economic features and can be financed with loan financing under close-to-commercial terms. However, there are a number of persistent barriers, such as legislative, institutional, socio-economic, and low-awareness that impede large-scale uptake of energy efficiency investments in the market.
In particular, it is suggested that the government take the following urgent steps:

To eliminate the barriers in the legal framework for energy efficiency:

1. Introduce binding legislation (a new law or a technical regulation) stipulating energy auditing, passportization, certification and labeling of buildings, mandatory enforcement of building energy codes with compulsory application to new buildings as well as with gradual application to already existing ones[26] to harmonize with energy efficiency certification (EEC) policy and regulatory requirements and EU Directive on Energy Performance Indicators in Buildings.
2. The legal reform in the field of energy saving and energy efficiency to ECU membership and transposition of the ECU regulations. To implement this approach the following steps will be necessary:
3. Make appropriate changes and amendments in the Law on Urban Development allowing to stipulate mandatory norms for energy efficiency in design, construction and exploitation

[26] It is noteworthy that, unlike other fields, this sector has a unique feature of energy efficiency mandatory application. In the field of industry, for instance, there are no incentives, no mixed private and common property areas, which would lead to inefficient use of energy, and industry owners possess capital investment funds (own or borrowed) for various modernization measures, including energy efficiency ones. In addition, in the industrial sector, the energy efficiency requirements, if imposed by Government, despite the cross-cutting monetary and non-monetary benefits, due to lack of awareness can be considered as an investment burden, barrier to growing local production, which is not politically acceptable, and not in line with the Government of RoA politics over the recent years to create favorable investment climate for local producers and international investors While the public sector does not usually need strong legal instruments, as the Government has its internal tools to implement energy efficiency measures in the public sector. As for the residential sector, it has a complex ownership structure, split interests in relation to private, rented and shared spaces, mixed property level in multi-apartment buildings; old buildings, limited access to capital, and a malfunctioning system of self-organization and collective decision-making. Therefore, in new buildings, where it is easier and less expensive to implement, the energy efficiency should be a mandatory norm and the energy efficiency of the existing buildings should be assessed and published.

phases for cases specified by legislation.

4. Based on the above requirements of the law, secondary legislation reflecting transposed relevant EEC regulations can be enacted These can be adopted as:
    a. Technical regulations in accordance with RA Law "On Technical Regulations" can be adopted by RA Government Resolution (especially when there is unavoidable need to refer to international/regional/national standards). The technical regulations will define energy auditing, certification and labelling procedures in accordance with the local geographic and climatic conditions, and acting laws.
    b. Normative-technical documents based on the RA Law "On Urban Development" (in cases where reference to international/regional/national standards is not necessary)
5. Assign clear responsibility and eliminate institutional overlap in this field of energy efficiency in buildings;

The Republic of Armenia has abandoned the path towards association with the European Union, but the years spent in negotiations have shaped up the list and timeline of harmonization of the RoA legislation standards with the EU directives and standards, which has been approved by RoA Government resolution No.1481 from 22 November 2012. The transposition of the Energy Performance in Buildings Directive has been assigned to the Ministry of Energy and Natural Resources with support from line Ministries including Urban Development, Economy, Transport and Environment and was performed in the form of draft Technical Regulation with support of UNDP-GEF project. From the January 1st 2015 Republic of Armenia became full member of the Eurasian Customs Union (ECU). In this regard the policy in the fields of EE and RE is to update the existing legal and regulatory field to comply with ECU requirements. In particular that will affect the EE labelling of products, Energy Audit procedure and requirements, buildings EE certification, etc.

Technologies and energy efficiency practices to be promoted

- Energy efficient technologies/measures to be promoted: integrated building design approach, including building envelop, heating system, ventilation, solar water heating, and lighting.
- Cost effective energy efficiency measures mainstreamed in the on-going renovation/ rehabilitation/seismic reinforcement of the existing buildings implemented in the framework of state programs.
- Energy efficient management/maintenance practices, including building level and sector level energy management systems, and use of the building.

The above issues have been outlined in the first NEEAP and dealt with in part by the ongoing reform efforts supported by donors. Pilot projects and financing schemes successfully demonstrated the effectiveness of various technical energy efficiency solutions, as well as organizational and crediting solutions, which have potential for scaling up. In other cases, such as the existing multi-apartment residential buildings, still efforts are needed to establish a

sustainable and functional solution for improving the energy efficiency of these buildings.
The Table below summarizes the activities implemented aimed at meeting the regulatory objectives of the first NEEAP.

The regulatory initiatives which have contributed to the achievement of the first NEEAP targets is presented below (the complex programs and initiatives which have both a regulatory and a financial element, as well as have mixed financing eligible for buildings and non-buildings projects are presented in the EE Financing Activity as cross-sectoral measure):

Table 25. Summary of Regulatory Measures for Energy Efficiency Improvement from 1st NEEAP

No.	1st NEEAP Measure	No	Title of the energy saving measure	end-use targeted	Duration	Status in relation to 1st NEEAP	Additional comments
II.1	National Building Code considering energy performance of buildings[27]	II.1	Development and adoption of the new building codes: • MSN "Thermal Protection of Buildings" • MSN "Thermal Networks" • MSN "Thermal Insulation of Equipment and Pipelines"	Buildings	2010 - 2014	Partially implemented	Expected to be finalized and adopted in 2015
II.2	Standards and calculation methodology to assess energy performance in buildings	II.2.a.	Development and adoption of the National standard AST 362-2013 "Energy efficiency. Building energy passport. Main provisions. Typical forms"	Buildings	2012 - 2013	Implemented as planned	Registered in accordance with the current procedures by the National Institute of Standards (SARM) on December 18, 2013 (registration ID: AST 362-2013). The standard was enacted on January 1, 2014. http://www.nature-ic.am/res/pdfs/documents/EEB_reports_publ/Energy-Passport-Axuryan_Eng.pdf http://www.nature-ic.am/res/pdfs/documents/EEB_reports_publ/Energy-Passport-Goris_Eng.pdf http://www.nature-ic.am/res/pdfs/documents/EEB_reports_publ/Energy-Audit-Mush_Eng.pdf

[27]Note, the Armenian version of the NEEAP had erroneously translated the "Code" as a package of laws rather than a building construction code/norm

		II.2.b.	Adoption of EPBD based technical regulation "On Building Energy Performance"	Buildings	2013-2014	Partially implemented	Passed to the MoNP, approval pending In accordance with the RA Government decision N 1481-A of 22.11.2012 "On approving the combined list of legal acts subject to harmonization in the energy sector as envisaged by the draft EU-RA association agreement", harmonization of Directive N 2010/31/EU of the European Parliament and of the Council "On Energy Performance of Buildings" of 19.05.2010
		II.2.c.	Harmonization of 6 EN and ISO standards in relation of energy efficiency	Cross-sectoral	2013-2014	Implemented as planned	MoENR letter #03/22.2/1858-13 of 17.05.2013 initiated a harmonization process of the sector-relevant directives and standards in cooperation with the UNDP. Approved by the order of 17.09.2014 of National Institute of Standards CJSC of the RA Ministry of Economy and enacted on 01.11.2014.
		II.2.d.	Development of the technical regulation on the building safety, including provisions on building EE	Buildings	2011-2012	Partially implemented	Passed to the MoUD, approval pending
		II.2.e.	Amendments to the Law on Energy Saving and Renewable Energy	Cross-sectoral	2012-2015	Partially implemented	Passed to the National Assembly, approval expected in 2015
II.3	Institutional capacity-building for implementing and enforcing new standards	II.3.a.	The draft RA Law "On making an addition into the RA law "On urban development" submitted to the Ministry of Urban Development dated July 13, 2013	Buildings	2013-2015	Not implemented	This is included into the package of legislative amendments pertaining to the adoption of draft RA law "On developing the smaller center of Yerevan". The document is still in its status of draft pending the delayed adoption of the draft RA law "On developing the smaller center of Yerevan" and has reached its final discussion stage as of now.

		II.3.b.	The decision of RA Government "On implementation of energy saving and energy efficiency improvement measures in facilities being constructed (reconstructed, renovated) under the state funding".	Buildings, Public & Services	2014	Implemented as planned	Adopted by the RA Government on December 25, 2014, protocol decision #1504-N, developed in the frames of the UNDP.
		II.3.c.	Changes to the Gov.Decision on Energy Audits	Cross-Sectoral	2013 - 2015	Partially implemented	#1399-N from 2006 (modified in 2011 #1105-N) Passed to the Government and circulated, approval expected in 2015
		II.3.d.	- The energy efficiency and energy saving related tasks and functions were added in the MUD charter in 2013 by the Government decision N225-N (13 March 2013). According the 2014 Action Plan the MUD is currently elaborating a draft government decision "On application of measures directed towards increasing of energy saving and energy efficiency in objects constructed (reconstructed, renovated) by the state means". Workplan for 2015 includes new Housing Code development.	Buidlings, Public & Services			
II.4	Establishing quality assurance/quality control (QA/QC) standards that will support the certification of key buildingmaterials for energy performance.	II.4	2 laboratories were established for testing thermal-physical parameters of construction materials in Armenia. Over 14 materials were tested and certified.	Buildings, Public & Services	2012 - 2014	Implemented as planned	UNDP supported the establishment of 2 labs with state of art laboratory equipment. The laboratory is now enabled to test and certify insulation materials, providing opportunity for the specialists to use reliable, tested and certified materials and prefabricates in Armenia.

II.5	Set up road-test procedures for building certification and methodology for assessment of energy performance for pilot buildings	II.5.a.	"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"	Buildings, Public & Services	2012 - 2013	Implemented as planned	The Handbook was endorsed by the Minister of Urban Development of the Republic of Armenia (order #343 of November 6, 2013.) http://www.nature-ic.am/wp-content/uploads/2013/10/Advisory_Handbook_on_Insulation_2013.pdf/
		II.5.b.	Development of "Database of construction insulation materials and pre-fabricates"	Buildings, Public & Services	2012 - 2013	Implemented as planned	Database aims to facilitate activities of designers, students, constructors and other specialists. In general, the database encompasses more than 40 materials, pre-fabricates and their basic properties. http://www.nature-ic.am/res/pdfs/publications/EEB-database_insulation/database_eng.pdf
		II.5.c.	Changes to the Gov.Decision on Energy Audits	Cross-Sectoral	2013 - 2015	Partially implemented	#1399-N from 2006 (modified in 2011 #1105-N) Passed to the Government and circulated, approval expected in 2015
II.6	Training and education in correspondance with the promotion of integrated building design approach and new energy performance requirements in buildings	II.6.a.	Black Sea Basin 2007-2013 Energy Efficiency Program strengthening the administrative capacity of local authorities and exchange good practice knowledge in energy efficiency in buildings, Black Sea Join Operational Program. Trainings including: - Study Tour on Energy Efficiency, Renewable Energy and Other Eco Solutions in Buildings in Armenia; - A Public Seminar on Energy Efficiency in AUA; etc.	Buildings	2007 - 2013	Implemented	

		II.6.b.	UNDP/GEF Improving EE in Buildings Program held multiple trainings and seminars aimed at building experts' capacity as follows:	Buildings	2010-2015	implemented	• Strengthening National Capacities for Housing and Urban Planning in Armenia 2015/04/10 • Seminar in the Frame of the International EE Day Held in Architects Union of Armenia 2014/11/14 • Two-Day Training on the Czech Experience of EE in Buildings 2014/10/22 • Seminar over Issues of Thermal Protection of Buildings for the RA State Urban Development Inspectorate 2014/08/01 • Energy Week 2014 Launched 2014/07/07 • Current issues in thermal protection of buildings: a seminar 2014/04/14 • South Caucasus Infrastructure and New Energy Investment Summit 2014 2014/02/14 • "Sustainability, LEED & Commissioning and How They Connect" Lecture at AUA 2014/02/04 • The current issues in production, testing and certification of thermal insulation materials in Armenia (02/10/2013) 2013/10/02 • Greening Energy Sector: VIII Annual REC Conference (25-26/10/2012)2012/10/25 • Energy for Sustainable Development, the Third International Forum (12-14/09/2012) 2012/09/12 • Improving EE in multi-apartment buildings: a training-seminar (26-27/07/2012) 2012/07/26 • Recent Developments per "Thermal

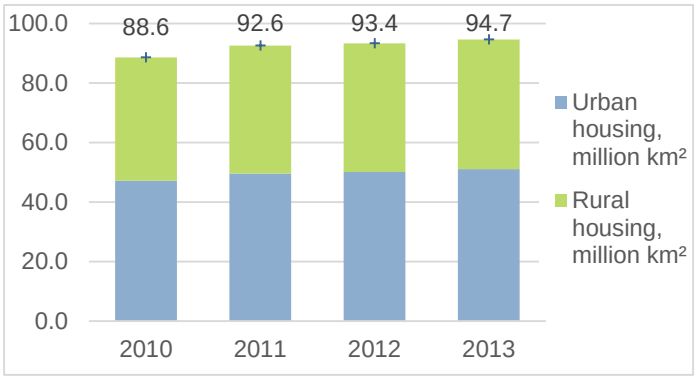
							Protection of Buildings" code (20/06/12) 2012/06/20 • Seminar on EE Design Approaches (02/05/12)2012/05/02 • Training on laboratory testing of construction materials (18-19/04/2012) 2012/04/18 • Energy Efficiency in a Community: Spitak (13/07/11) 2011/07/13
		II.6 .c.	INOGATE Technical Secretariat, SEMISE & ESIB Programs held a series of trainings and seminars related to energy efficiency, energy auditing, EE finance, ESCOs, etc:	Buildings			

II.7	Pilot Project: Design competition and construction of several "best-practice" buildings (e.g. school or other public the construction of a typical building.approach within available budget and time schedule for building, and a multi-family house) in Yerevan and another larger city, using an integrated building design	II.7.a.	Pilots on energy efficiency in residential buildings		2012 - 2015	Implemented as planned	Pilot building in Goris 2012: Energy savings - 109 MWh/year CO2 emission reduction - 25 ton/yearPilot building in Avan 2014Energy savings - 290 MWh/year CO2 emission reduction - 60 ton/yearCascade Hills residential complexEnergy savings - 496 MWh/year Solar water heating collectors ~ 19 pilot projects of solar energy utilization and about 600m2 of solar thermal collectors installed throughout Armenia. CO2 emission reduction from the implemented pilot projects (as of 2014): about 215 tCO2eq annually.Private investment leveraged for completed/ongoing projects on the application of renewable energy solutions totaled to about USD 1 million.
		II.7.b.	Pilots on energy efficiency in public buildings through energy saving agreement scheme which cover the investment loan from energy savings.	Public Buildings & Services	2013 - 2015	Implemented as planned	The World Bank is supporting improvements in the energy efficiency of social and other public facilities (e.g., schools, kindergartens, hospitals, streetlighting, other public buildings) supports energy-efficiency investments in social and other public facilities through energy saving agreements and energy performance contracting. The Project Development Objective is to reduce the energy consumption of social and other public facilities. The global environmental objective is to decrease GHG emissions through the removal of barriers to the implementation of energy-efficiency investments in the public sector.

							Results achieved to date: - Projects implementedd include: - Energy saving measures completed and operation launched in 27 public buildings; - Construction works underway on 15 sites; - In procurement stage: 14 projects - Under review: 9 applications Total approved (of 309 received): 65 applications Government of Armenia (GoA): EUR 12.7 million Investment grant: EUR 8.0 million. Average investment cost: 8400 AMD/m2; Average payback: 6.4 years; Average saving: 50.8 %
II.8	Development of an incentive scheme to promote energy efficient construction or reconstruction in residential and service buildings	II.8	not implemented				

4.1.3 Residential Buildings

This section deals with existing residential buildings. Armenian housing sector comprises about 95 million km^2, of which 54% is in the urban settlements and 29% are in multi-apartment buildings.



Armenia's housing stock

19,000 dwellings, 822,000 units, of which:

In Private houses:

- 427,000 units
- 71% of total housing space

in Multi-apartment buildings:

- 435,000 dwellings (52 %) are in the multi-apartment stock,
- 29% of total housing space

Figure 27. Total housing stock and breakdown by urban and rural settlements, million km^2. 2010-2013

About 30% of all multi-apartment housing is made of panel or monolith concrete, which is 40% below EU average. As can be seen on Figure 28, only 40 % of the overall housing stock is over 40 years old. The private houses, comprising the one third of all housing space is relatively well maintained. A number of credit lines have been offering residential energy efficiency loans (IFC, EBRD, AFD/NMC, GGF) with some degree of incentives, such as lower interest rates or grant money back. This section reviews activities focusing on residential energy efficiency exclusively. The scale of impact of those credit lines, which finance residential energy efficiency among other sectors, is assessed in Table 26 among the cross-cutting measures.

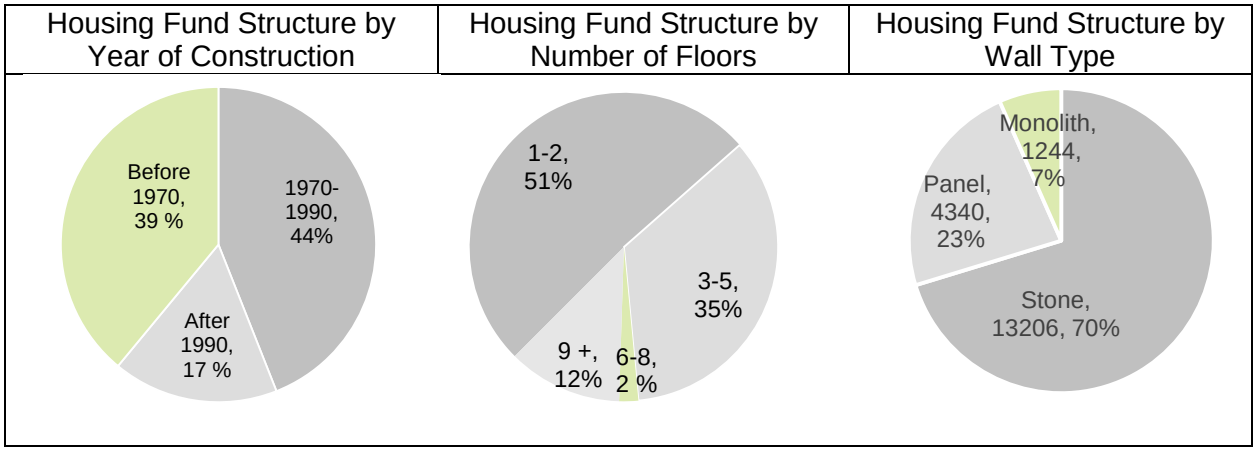


Figure 28. Structure of MAB stock by age, floors, and construction material

Yet in the multi-apartment housing this trend has not evolved. The overall ownership scheme in multi-apartment buildings and of management and maintenance of common owned property is highly inefficient, which hampers the uptake of energy efficiency opportunities by the multi-apartment housing market.

The 2002 Law on Apartment Building Management did not adequately legislate and enforce the rights and responsibilities of condominiums. Consequently, multi-apartment housing repair and maintenance does not work well. Deterioration worsens from year to year. Not less than 75% of all roofs and roof drain systems are in urgent need for repair. A growing number of residential buildings are in urgent danger of physical destruction. This situation aggravates the serious seismic risk in Armenia. Investments in housing repairs are insufficient. For example, in 2008 less than AMD 1 billion ($ 2.7 mln) was invested in the whole stock of multi-apartment buildings. The extremely low maintenance fees allow for not even the most urgent repair works. Similar serious is the collection rate of hardly over 60%. Debts on maintenance fees are set too low to supply sufficient funds for adequate maintenance, and are very difficult to levy. Clarification and a redefinition of the roles of owners on the one hand and of the management organizations on the other hand are urgently needed. Several initiatives have thoroughly analyzed the origins of the problems in the existing housing sector, and repeatedly concluded that the lack of investments in housing repair and maintenance, as well as adequate thermal rehabilitation.

To address the issues within the housing sector, the conservation and maintenance of common space and supporting infrastructure in urban housing, the Armenian Government with assistance from partners (international aid organizations) has pursued major policy reform efforts that concern utility supply, public utility regulation, organization of multi-apartment building management bodies and condominiums, housing policies, municipal budget autonomy, revenues, etc.

To date, the accumulated experience and expertise have demonstrated that energy efficiency improvements can help vulnerable households in Armenia, and that energy efficiency is the quickest, cleanest and cheapest way to bring comfort and economic mitigation to these

households. IFI resources can cover only a small fraction of the investment needs of this sector; the private sector should thus be tapped for investment capital to address the modernization and efficiency improvement needs over the next 20-30 years.

The potential for energy efficiency in the buildings sector has been estimated. Armenia is not an exception: the latest studies have confirmed potential for energy saving. The National Program on Energy Saving and Renewable Energy estimates 40 percent potential for energy saving in Armenia's building sector.

According to the results of donor-funded pilot projects, an average residential building in Armenia has 30-50% potential for energy saving at current energy prices. The most illustrative of all were the pilot projects implemented by UNDP/GEF Improving Energy Efficiency in Buildings project. The thermal modernization of a multi-apartment panel building in Yerevan reduced 178kWh/m2 energy consumption to 74kWh/m^2 after thermal rehabilitation of the building façade.

Moreover, the Habitat for Humanity of Armenia (HFHA) has also found the lending model and implemented loan-funded thermal envelopingof 3 existing typical panel buildings. The Municipality of Yerevan has provided grant co-financing for such loan-financed projects within the scope of a bi-lateral memorandum of understanding with HFHA. In some cases, the investments received a modest co-financing by residents (home-owners' association).

In addition to EBRD, IFC and GGF loans for energy efficiency investments, the French Development Agency (AFD) and the National Mortgage Company (NMC) have launched the "Jerm Ojakh" Social Energy Efficiency Renovation Program for Armenia's Housing Sector. KfW plans to launch a Housing Energy Efficiency Credit line in 2016, which will also be partnered with NMC and seek to cover another niche for residential energy efficiency.

The barriers to energy efficiency investments in multi-apartment residential buildings can be summarized as follows:

- Lack of housing strategy or clear policy on state/local government responsibilities to vulnerable groups;
- Clear separation of responsibilities among state and local authorities;
- Private-sector involvement in housing industry and finance;
- Improvements of eviction, foreclosure and bankruptcy mechanisms to conduct legally transparent and sustainable transactions in real estate, including sales and other transfers of nonperforming loans and,
- Implementation and enforcement of acting laws and regulations in the field of multi-apartment building maintenance and management
- Weak capacity for building management, project development, financial planning and management, fund-raising, human resources, reporting and customer/member relations.
    - Survey revealed up to 20% HOA managers still initiate cash-paid service recruitment
    - Up to 20% of HOAs implement maintenance work no more frequently than once every 1-2 years
- Lack of financial resources due to low maintenance fee rates and low collection;
- Poor creditworthiness due to their new status, slow development, failure to collect service fees, and failure to conduct creditworthy accounting, bookkeeping and reporting.

- Difficulty securing the necessary number of votes for strategic decision-making with respect to heat supply issues; the situation is exacerbated by the growing number of autonomous apartment-level solutions) and the significant share of absentee households (~20%);
- The need, often, to sign individual loan repayment and service supply contracts with each households due to mistrust and lack of experience of purchasing utility services from the intermediary.
- Lack of overall awareness and understanding of the legal-regulatory framework, rights and responsibilities related with the home-owners' associations, and benefits of EE, in general.

To adequately direct investments in this sector, policy reform, capacity building, outreach and adequate financing schemes are necessary. The RA Law on Condominiums should be recognized as ineffective.

The Ministry of Urban Development recognized the need to amend or rewrite Law on MAB Management, with appropriate amendments to be provided to the RA Civil Code regarding provisions of management of multi-apartment buildings, and the RA Government Decree N1161-N on Adoption of Obligatory Norms of for Maintenance of the MAB Common Shared Properties revisited. This reform must be accompanied by a national program for promoting residential building energy efficiency, aimed at the following actions:

- Assess the investment needs of the sector (including for financing of the 5-year Strategic plan of MAB housing fund management, maintenance and exploitation of RA adopted by Minutes decree of RA Government #38 on 29.09.2011)
- Define the procedures for lending to MAB management and/or maintenance bodies, and availability of state subsidies for organizing comprehensive refurbishment and energy efficiency retrofits in the housing stock
- Design a financing scheme with features customized to economic features MAB retrofit projects, with 'soft' terms, and combined with grant financing and technical assistance
- Seeking grant resources to support investments for low-income households from state social safety funds;
- Cultivate PPPs to facilitate investment in MABs, eliminate legal & institutional barriers for attracting private capital.
- Utilize lessons learned from demo projects, test-drive programs on small-scale pilots.
- Seek opportunities to capitalize on sectoral programs to finance housing rehabilitation (environmental, EE, seismic, etc.)
- When loan-financing investments in MABs, have special provisions (grants) for vulnerable households.
- Enable the participation of the HOAs in residential investment projects by finding creative solutions for loan financing.
- Collect adequate M&E data through to document impacts and fine-tune the programs for improved effectiveness.

To strengthen the institutional capacities for improved efficiency of energy use in the housing Sector

1. Capacity strengthening for the relevant State institutions and public services related to the energy efficiency in buildings for overseeing existing buildings and ensuring effective enforcement of the MAB management and condominium policy including HOAs, regional and

local authorities, energy auditors, urban development inspection, private housing maintenance companies, as well as financial institutions interested in lending for housing maintenance and energy efficiency.

2. Technical assistance with respect to home-owners' associations (HOAs) ability to participate in the new procedures stipulated by the 5-year Strategy Program and overall reform in the sector, including lending to HOAs for EE improvements, competitive procurement of private maintenance services by HOAs, assessment of buildings' energy efficiency potential, conduct of energy audits, development of energy efficiency investment projects, passportization of buildings', etc

3. Raise public Awareness providing information on end-use energy efficiency measures and their benefits to decision-makers as well as consumers.

Recommended features of an effective financing scheme for residential energy efficiency:

4. Design a Financing Scheme with features customized to economic features MAB retrofit projects, with 'soft' terms, and combined with grant financing and technical assistance
5. Seeking grant resources to support energy efficiency programs for low-income households from state social safety funds to replace traditional tariff subsidies for natural gas;
6. Cultivate public-private partnerships private maintenance or energy service companies with municipalities, private housing maintenance firms and HOAs to facilitate the elimination of institutional barriers while attracting private capital.
7. Utilize lessons learned from demonstration projects to inform government policies on the choice of institutional and regulatory reforms, and test-drive the programs on small-scale pilot scale, roll-out to offer a standard solution in regular commercial banks/local financial institutions (LFIs).
8. Seek opportunities to capitalize on environmental benefits of energy efficiency in residential buildings, for instance through environmental funds or carbon financing.
9. Value of Non-monetary Savings considering that residential energy efficiency may not always bring to financial savings but to significant non-monetary improvements in lifestyle, comfort, health and environment.
10. When loan-financing residential energy-efficiency programs for multifamily buildings, have special provisions (grants) for vulnerable households so that they may participate.
11. Enable the participation of the HOAs in Residential EE investment projects by finding creative solutions for loan financing to HOAs.
12. Collect adequate data through monitoring and evaluation to document impacts and fine-tune the programs for improved effectiveness.
13. Create security funds to insure loans for condominiums in the case of collateral deficiency;
14. Provide funds for reconstruction, energy efficiency measures, preparation of technical and financial documents as well as for the application of innovative technologies.

The financial and economic benefits of energy efficient building are well-researched and documented internationally. Many energy efficiency investments have a short payback periods in terms of reduced energy costs (considering energy efficiency in the design of a building could even reduce construction costs. The few studies considering the national circumstances of Armenia (construction costs, established market prices for construction materials, heating, conditioning and ventilation costs) confirm

these findings.[28]The profitability of energy efficiency will further increase with rising energy prices. This will for public buildings and social housing result in a substantial saving of the scare public resources for construction and operation of buildings. For residential buildings energy efficiency will be the only way to maintain utility affordability with the rising energy prices, while maintaining an adequate comfort level.

National Program for MAB Housing EE Retrofits

It is recommended that the pilot project experiences from UNDP/GEF and HFHA/REELIH programs are scaled up into a national program for residential energy efficiency addressing the policy reform, capacity building, development and scaling up of a sustainable financing scheme for multi-apartment building retrofits in Armenia. See new EEIM proposed (measure II.10).

LED Lights for Low-Income Households

In addition to the investments and measures to help reduce the building sector demand for heating energy, the residential sector needs support dealing with the growing electricity prices. As discussed earlier in regulatory section, the rising energy tariffs have had substantial impact on energy affordability and social acceptance of the announced tariff increase, triggering civil unrest. To avoid another instance, when the Government spend scarce public funds to subsidize the energy prices to avoid political turmoil, it is recommended that the energy social safety nets make a transition from tariff subsidies to subsidized energy efficiency programs for low-income households. The latest 7% increase proposed for electricity prices needs to be remedied with such assistance. About 40% of electricity use in low-income households (Armenia has 225,000 poor households, of which 105,000 – classified as extremely poor) is for lighting purposes. To help manage the electricity consumption within affordability limits, it is proposed to offer replacement LED lights-bulbs to low-income families. (See Measure II.11).

Appliance Energy Labeling Outreach

Another tool that helps the population deal with the energy demand-side management, for middle- to high-income range population, is the appliance energy labeling. The UNDP-GEF had prepared a draft Government Decision and energy labelling regulation, which were both submitted to the Ministry of Energy and Natural Resources for adoption. The adoption was on hold before the political rout with regards to EU association and ECU membership is resolved. Now with Armenia's member status in ECU, the regulatory package must be

[28]The 2007 National Program of RA for Energy Saving and Renewable Energy estimated a total annual energy saving potential in the building sector equivalent to 331 ktoe through improvement of thermal protection of buildings, introducing energy efficient lighting and heating systems.

adapted and adopted. Upon adoption, enforcement of appliance energy labeling regulation requires a substantial outreach effort to help introduce the labels, disseminate information and adequately inform consumers' purchasing decisions. (EEIM II.12.).

Table 26. Energy Efficiency Improvement Measures in Residential Buildings

No	Title of the energy saving measure	End-use targeted	Duration	Achieved energy savings in 2014 (MWh)	Achieved energy savings in 2017 (MWh)	Achieved energy savings in 2018 (MWh)	Achieved energy savings in 2020 (MWh)	Status in relation to 1st EEAP
II.7	Legal Support, Financing and Information: Improvement of Energy Efficiency in Buildings; development of secondary legislation for EE in buildings, as well as funding for the first pilot thermal modernization of a residential multi-apartment building in Avan district of Yerevan and social housing in Goris and Akhouryan towns (UNDP/GEF BEEI project).	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2013; End: 2017	1,200	1,200	1,200	1,200	partially implemented
II.9.a.	Financing for Energy Efficiency: Household energy efficiency loans and EE mortgage loans (NMC/AFD)	Household EE loans and EE mortgage loans ; residential buildings and private homes' space heating, hot water preparation	Start:2014 End: 2020	136	141	164	211	partially implemented
II.9.b	Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	residential energy end-use in space heating and hot-water preparation	Start: 2013; End: 2018	30	4,914	5,067	5,067	partially implemented

II.9.c.	Financing for Energy Efficiency: KfW Housing EE credit line	Residential energy end use, heating, hot water preparation, lighting	Start:2016 End: 2020	new measure	The exact EE savings depend on the specific measures which will be financed through the sub-loans.	Appropriate indicators and energy saving forecast will be provided as soon as the project concept is fully developed.	TBD	pending
II.10	Mitigating Tariff Increase with Low-income Energy Efficiency Program	Residential energy end use, lighting efficiency	Start: 2015; End: 2016	new measure	116,159	116,159	116,159	new measure
II.11	EE Retrofits in existing residential buildings: National Program and Action Plan for MAB Renovation & EE	Existing residential buildings, space heating	Start: 2016; End: 2020	new measure	65,000.00	65,000.00	65,000.00	new measure
II.12	Appliance Energy Labeling Awareness Campaign	Residential energy end use, lighting efficiency	Start: 2015 End: 2020	new measure	176,704	209,369	409,635	new measure
Sum of savings:			**MWh**	1,366.26	364,117.58	396,959.02	597,271.89	
Sum of savings:			**KTOE**	0.12	31.31	34.13	51.36	

Individual measures contributing to legal-regulatory reform, financing and capacity building for improved energy efficiency of the residential building sector are presented in the below individual tables.

Title of the Energy Saving Measures		**UNDP/GEF Improving EE in Buildings Program (Building EE Project)**
Index of the measure		**II.7**
Description	**Category**	EE Programs and Measures, Regulatory, Information
	Timeframe	Start: 2013; End: 2017
	Aim/brief description	The project is aimed at improving Energy Efficiency in Buildings including massive support to the Armenian Government in transposition of EPBD, development of secondary legislation for EE in buildings, as well as funding the first pilot thermal modernization of a residential multi-apartment building in Avan district of Yerevan, as well as social housing in Goris and Akhouryan towns.
	Target end-use	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings
	Target group	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Pilot building in Goris 2012: Energy savings - 109 MWh/year; CO2 emission reduction - 25 ton/year; Pilot building in Avan 2014 Energy savings - 290 MWh/year; CO2 emission reduction - 60 ton/year Cascade Hills residential complex: Energy savings - 496 MWh/year; Solar water heating collectors ~ 19 pilot projects of solar energy utilization and about 600m2 of solar thermal collectors installed throughout Armenia. CO2 emission reduction from the implemented pilot projects (as of 2014): about 215 tCO2eq annually. Private investment leveraged for completed/ongoing projects on the application of renewable energy solutions totaled to about USD 1 million.
	Budget and financial source	$1,200,000
		UNDP/GEF
	Implementing body	MoNP, UNDP/GEF
	Monitoring authority	UNDP/GEF
Energy savings	**Method for monitoring/ measuring the resulting savings**	NBU

	Savings achieved in 2014 as per 1st EEAP (MWh)	1,200
	Expected energy savings in 2017 (MWh)	1,200
	Expected energy savings in 2018	1,200
	Expected impact on energy savings in 2020 (if available)	1,200
	Assumptions **Overlaps, multiplication effect, synergy**	Horizontal/cross-cutting measures in EE policy Reform, EPB regulation

Title of the energy saving measure		**Residential energy efficiency bank-based commercial loan**
Index of the measure		**II.9.b.**
Description	**Category**	EE Programs and Measures
	Timeframe	Start: 2013; End: 2018
	Aim/brief description	The program worked on residential energy efficiency upgrades serving a total of 99 families in 3 buildings, with a total disbursement of roughly USD$ 6,000 per building and is the only entity that has succeeded in extending a bank-based commercial loan to a condominium in Armenia to 6 condominiums, more pending within their ongoing USAID-funded Residential Energy Efficiency for Low-Income Households (REELIH) program.
	Target end-use	residential energy end-use in space heating and hot-water preparation
	Target group	Residential households, condominiums, municipalities
	Regional application	National

Information on implementation	**List and description of energy saving actions substantiating the measure**	Habitat for Humanity of Armenia (HFHA) has several programs addressing housing finance and residential energy efficiency and renewables. 1.Residential EE for Low-Income Households (REELIH) funded by USAID grant, aimed at establishing near-commercial lending for residential energy efficiency; 2. Condo: HFHA housing finance with focus on condominium EE lending for common-space EE retrofits and overall repairs. On-lending of similar loans through 3 local universal credit organizations (UCOs): 3. New Horizon UCO 4. Kamurj UCO 5. First Morgage Company (FMC) 6. EC SUDEP Project funds EE and RE solutions for Covenant of Mayor signatories Spitak and Vayq towns
	Budget and financial source	$ 3,629,507
		provided by: Habitat for Humanity Armenia (HFHA), European Commission, USAID-funded REELIH program
	Implementing body	Inecobank, UCOs
	Monitoring authority	USAID, European Commission
Energy savings	**Method for monitoring/ measuring the resulting savings**	NBU
	Savings achieved in 2014 as per 1st EEAP	30
	Expected energy savings in 2017 (MWh)	4,914
	Expected energy savings in 2018	5,067
	Expected impact on energy savings in 2020 (if available)	5,067
	Assumptions	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Social & Energy Efficiency Housing Finance Program in Armenia: Jerm Ojakh, AFD/NMC**
Index of the measure		**II.9.a.**
Description	**Category**	EE Programs and Measures
	Timeframe	Start: 2014
		End: 2020
	Aim/brief description	Household energy efficiency loans and EE mortgage loans by French Development Agency and National Mortgage Company: The program is aimed to provide household energy efficiency loans and EE mortgage loans with a target of 3000 households to be reached within the first year of the program.
	Target end-use	Household EE loans and EE mortgage loans ; residential buildings and private homes' space heating, hot water preparation

	Target group	Residential buildings
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	The Agence Française Développment (AFD) has set up the "Jerm Ojakh" SEEHFP as a loan facility of EUR 10 mn, which aims at providing loans, for on-lending to private households outside Yerevan city Center and in the regions of Armenia to finance energy efficiency investments in social housing. through local PFIs at affordable conditions. Eligible measures include insulation, window and door replacement, SWHs, heating system replacement, as well as other general renovation. In order to overcome various barriers to sustainable energy investments, the Program is complemented by technical assistance funding from the EU NIF to PFIs as well as non-refundable grant funding from the EU NIF to borrowers. The Program aims at overcoming the main barrier in the implementation of energy efficiency investments, which is the lack of appropriate access to affordable financing. Given the amount of the credit line, the sub-loans will target approximately 3,000 households and will finance the households' renovation investments outside Yerevan city Center. The sub-loans will be offered in AMD and will be systematically granted after a simplified energy audit. They will have a longer maturity period than currently offered by commercial banks in the market and will have a grace period, as well as 5-10 grant bonuses for qualifying loans.
	Budget and financial source	$ 13,000,000
		AFD
	Implementing body	NMC and 15 participating financial institutions (PFIs)
	Monitoring authority	NMC, ASBA, KPC
Energy savings	**Method for monitoring/ measuring the resulting savings**	EUAMT tool
	Expected savings in 2014 as per 1st EEAP (MWh)	136
	Expected savings achieved in 2017(MWh)	1,635.25
	Expected energy savings in 2018*(MWh)	1,907.84
	Expected impact on energy savings in 2020 (MWh)	2,453.02
	Assumptions	Every loan is invested in some kind of home improvement which leads to an average of 44% energy saving
	Overlaps, multiplication effect, synergy	Overlaps with Building EE programs, synergy with KfW's pending residential EE lending credit line

Title of the Energy Saving Measure		**Financing for Energy Efficiency: KfW Housing EE Credit Line**
Index of the measure		**II.9.c.**
Description	**Category**	EE Programs and Measures, financing scheme
	Timeframe	Start: 2016

		End: 2020
	Aim/brief description	KfW intends to establish an EE Finance Program for residential housing in Armenia with a volume of up to EUR 20 million
	Target end-use	Residential energy end use, heating, hot water preparation, lighting
	Target group	Residential households
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	The target is to decrease the energy consumption in residential buildings and thus the Greenhouse gas emission by at least 20% compared to a baseline
	Budget and financial source	€ 20,000,000 KFW, 80% guaranty for the loan from the Federal Republic of Germany
	Implementing body	Borrower: Central Bank of Armenia. Program has been agreed upon by the Government of Armenia and the Government of Germany during the government negotiations in September 2014
	Monitoring authority	Program Management Unit: National Mortgage Company
Energy savings	**Method for monitoring/ measuring the resulting savings**	n/a
	Expected savings in 2014 as per 1st EEAP MWH	new measure
	Expected energy savings in 2017* MWH	The exact EE savings depend on the specific measures which will be financed through the subloans.
	Expected energy savings in 2018* MWH	Appropriate indicators and energy saving forecast will be provided as soon as the project concept is fully developed.
	Expected impact on energy savings in 2020 (if available) MWH	TBD
	Assumptions	Project appraisal in Q1/2015, Signing of agreements in Q2/2015, Start of implementation in Q3/2015
	Overlaps, multiplication effect, synergy	The effort will be implemented through NMC and will seek to complement and not overlap with the "Jerm Ojakh" product offered by NMC

Title of the Energy Saving Measure		***Mitigating Tariff Increase with Low-income Energy Efficiency Program: LED-ligthing for Low-income households***
Index of the measure		**II.10**
Description	**Category**	EE Programs and Measures
	Timeframe	Start: 2015; End: 2016

	Aim/brief description	Mitigating impact of electricity tariff increase on low-income households by offerring subsidized efficient (LED light bulbs) to replace incadescent light-bulbs in 225,000 households (32% of population categorized as below the poverty line)
	Target end-use	Residential energy end use, lighting efficiency
	Target group	residential sector, low-income households
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Develop Low-income Energy Efficient Lighting Program including: - provision of LED-light bulbs to all low-income households to replace incadescent bulbs; - development of a partnership with the electric utility to perform maintenance and replacement of these bulbs within an agreed limit.
	Budget and financial source	$ 9,092,687 provided by Government of Armenia
	Implementing body	Ministry of Energy and Natural Resources; Ministry of Labor and Social Affairs
	Monitoring authority	MoENR
Energy savings	**Method for monitoring/ measuring the resulting savings**	NBU
	Savings achieved in 2014 as per 1st EEAP MWH	
	Expected energy savings in 2017 (MWh)	116,159
	Expected energy savings in 2018 MWH	116,159
	Expected impact on energy savings in 2020 (if available) MWH	116,159
	Assumptions	Assuming that financing will be made available. Based on features of a small sample of HHs conducted by UNDP/GEF, that will need to be expanded. Assuming 35% of all electricity is used for lighting (in low-income HHs – would be more, such as 45-50%). From 8 to 16 light-bulbs per households, 10 on average. Assuming 1 is the bathroom and is not used at the 5 hour per day rate, suggested replacement of 9 bulbs per households. The average bulb is assumed to be 60 watt capacity, replacing with a 9.5 W/hr LED light bulb. Simple payback calculated for current tariff AMD 48.78 equals 5 months
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure	**EE Retrofits in existing residential buildings: National Program and Action Plan for MAB Renovation & EE**

Index of the measure		**II.11**
Description	**Category**	Financial instruments, Information
	Timeframe	Start: 2016; End: 2020
		The EEIM implementation speed will depend on the sector readiness, capacity building of beneficiaries, and market conditions
	Aim/brief description	The measure suggests that the Government of Armenia, in cooperation with donors and IFIs, designs a comprehensive action plan for the rehabilitation of existing residential buildings by the end of 2020 and the implementation of that plan. The plan attention focuses primarily on multi apartment residential buildings and weatherization of building envelope. This measure provides energy certification before and after energy renovation.
	Target end-use	Existing residential buildings, space heating
	Target group	HOAs, private housing maintenance companies
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Preparation of multi-year Action; Plan for the renovation of residential buildings till 2020; Roll-out for replication through commercial banks;
	Budget and financial source	$ 25,000,000 IFIs
	Implementing body	Donors, IFIs/LFIs, PS, HOAs, ESCOs, MUD
	Monitoring authority	MUD
Energy savings*	**Method for monitoring/measuring the resulting savings**	NBU
	Savings achieved in 2014 as per 1st EEAP (MWh)	
	Expected energy savings in 2017 (MWh)	65,000.00
	Expected energy savings in 2018 MWH	65,000.00
	Expected impact on energy savings in 2020 (MWh)	65,000.00
	Assumptions	The measure recommends that the Ministry of Urban Development initiates a national program for energy efficiency in multi-apartment residential buildings (MABs) in the Republic of Armenia. The program must include: - legal-regulatory reform eliminating barriers for lending to home-owners associations (HOAs); - capacity building and institutional strengthening to prepare the HOAs, local financial institutions (LFSs) and private sector for effectively utilizing the energy efficiency opportunities in the MABs;
	Overlaps, multiplication effect, synergy	To achieve multiplier the effect and to increase the interest of the apartment owners in the restoration of its buildings and apartments, it is in the common interest to effectively showcase the completed projects and the benefits they bring to the households. Activities under this measure that are related to building

		refurbishment overlap with the legal regulatory efforts on energy efficiency policy, and efforts by HBHA. These are complex thermal modernization measures that are subject to a comprehensive program.

Title of the energy saving measure		Energy efficiency labelling of energy-consuming household appliances
Index of the measure		II.12
Description	Category	Information and mandatory information measures
	Timeframe	Start: 2008.
		End: end of 2012.
		The measure continues with anticipated certain changes, additions and improvements.
	Aim/brief description	Using the provisions of the EC Directives as the basis for defining labelling requirements, in 2010 the UNDP-GEF project conducted a study to find the best approach for introducing an energy efficiency labelling system for energy consuming household appliances in Armenia. As a result of this study, a draft Government Decision and energy labelling regulation were developed. Since this was the first time a labelling regulation had been applied in Armenia, a phased approach was proposed, with only a limited number of household appliances subject to labelling in the first phase. The prepared materials need to be harmonized with the Eurasian Economic Union requirements and a labeling outreach campaign designed and launched.
		The list of appliances subject to labelling would then be gradually enlarged. To this aim, the corresponding international and European (CEN) standards on testing the energy performance of selected energy-consuming household appliances were translated and adopted.
		The UNDP-GEF prepared a draft Government Decision and energy labelling regulation, which were both submitted to the Ministry of Energy and Natural Resources for adoption. Approval was expected in 2013. Not adopted until now.
	Target end-use	Existing residential buildings, appliance replacement
	Target group	Property owners, tenants
	Regional application	National
Information on implementation	List and description of energy saving actions substantiating the measure	Increased awareness and consequently modified end-user behavior.
	Budget	$5,000,000
	Financial source	TBD
	Implementing body	MoENR, producers and importers/distributors/suppliers of energy-consuming household appliances, and households

	Monitoring authority	MoENR
Energy savings*	Method for monitoring/measuring the resulting savings	In order to monitor the effects of this measure it is necessary to ensure the use of TD method recommended by the European Commission.
	Expected energy savings in 2017 (MWh)	176,704
	Expected energy savings in 2018 (MWh)	209,369
	Expected impact on energy savings in 2020 (MWh)	409,635
	Assumptions	The tracking the realization of this measure, and with that, the estimate even with the TD methods have become difficult earnings to the lack of information concerning the number of the energy-consuming household appliances which are placed on the market, how much following equipment was purchased and in which classes on energy efficiency belongs.
	Overlaps, multiplication effect, synergy	This is a horizontal measure.

4.2 Public Buildings and Services

4.2.1 Public Buildings

Schools, universities, colleges, kindergartens, medical institutions and athletic facilities comprise 92% of all public buildings. Over 40% of all public buildings are located in the capital of Armenia.

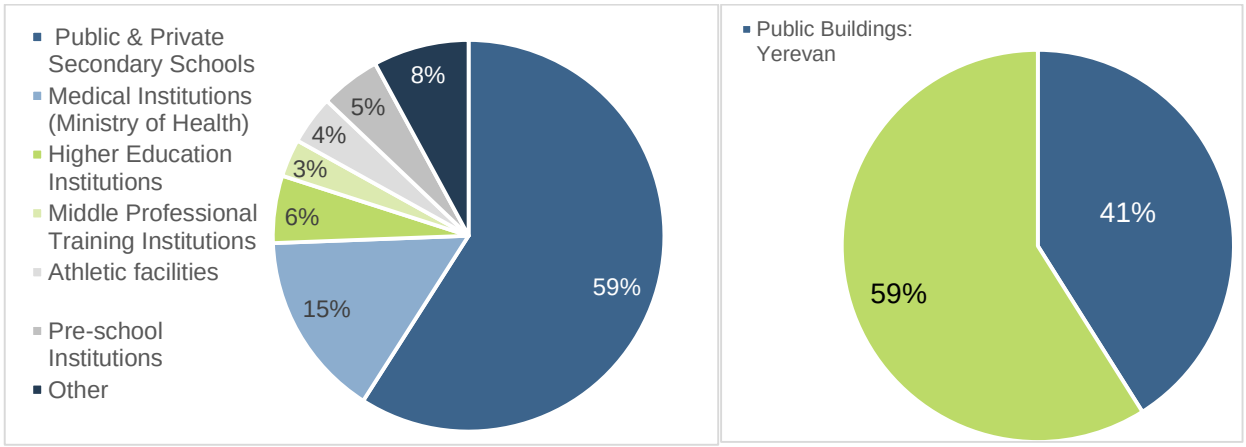


Figure 29. The number and area of public buildings in Armenia, 2013

Source: NSS, and calculations of authors based on average building size, where statistics was not available.

Majority of public buildings are under governmental ownership, control and direct co-financing. The Ministry of Urban Development is the lead state agency in the field of housing construction and urban development, while other branch ministries manage and oversee their respective premises (e.g. Ministry of Health in charge of medical institutions) for the purposes is routine maintenance and repair. Majority of public buildings have very low energy performance, largely due to the age, poor condition of building envelope as well as lack of adequate energy management. On average such buildings have 10-70% potential for energy saving. With energy costs comprising 5-20% of running costs of most public institutions, they still supply an average comfort level of approximately 40%. The current financing scheme of public institutions per person (per patient bed in hospitals, per student at educational facilities) created a possibility to utilize borrowed resources for energy efficiency retrofits, and cover the investments from savings. Such energy saving agreements have successfully been implemented by Armenia's Renewable Resources and Energy Efficiency (R2E2) Fund. In 2012 the government of Armenia signed an EE program (worth 10.7 million USD) supported by the World Bank and implemented by the R2E2 Fund. The program is targeted to implement energy saving activities in public facilities to reduce the level of energy consumption by social and other public facilities.

- Energy efficiency would free up the scarce public budgets for this sector. Without energy efficiency, the expected increase of energy prices will increase the demand for public budgets.
- Within the overall framework of the national energy security and growing energy prices, and constrained budget resources in public buildings, energy efficiency is the shortest, cheapest way to help reduce country's energy import dependence, curtail the energy expenditures of public budgets, while mitigating climate change.
- Finally, addressing this sector could secure the necessary market transformation, which will have an indirect impact on private buildings (housing and commercial buildings) as well.

As to energy efficiency in building reconstruction, despite the higher cost (than in case of new construction) the growing energy prices have made these investments cost-effective. The GEF-funded program in Armenia targeted to building energy efficiency (R2E2's "Energy Efficiency Project" and "Improving Energy Efficiency in Buildings" UNDP-GEF project) have proven that energy efficiency investments with positive net present value and 7 years of simple payback can save over 50% of energy compared to baseline consumption both in residential and public buildings. R2E2 experience in public building energy efficiency retrofits firstly indicated that these buildings were in such poor state of maintenance and repair that would require substantial investments in rehabilitation without prospects for cost recovery. R2E2 estimated with incremental investments of about \$17-20 per m^2 (this is equivalent to approximately 10% of the common average \$200/m^2 for comprehensive building rehabilitation) the natural gas consumption for heating can be reduced twice, correspondingly the GHG emissions will be reduced by around 50%. The baseline heating energy demand of 120-125kWh/m^2/year is ensuring only 40-50% comfort level, the EE measures allowed improving the comfort to acceptable levels within the existing budget constraints. These improvements are achieved by a

comprehensive energy efficiency improvement package including insulation of walls/finishing, replacement of doors and windows, replacement of windows by walls, and roof insulation, after an efficient heating system has already been put in place. The R2E2 credit line has very strict eligibility criteria and can only finance energy efficiency measures which have attractive economic indicators (positive net present value) and only accept applications from public buildings where the comfort level is beyond 50%. As a result, the energy efficiency measures which may result in substantial greenhouse gas mitigation but has lower cost-effectiveness or is proposed for suppressed demand conditions will not be eligible for finance.

The demand for energy efficient construction and renovation is much larger than the funds, currently available in Armenia. To this purpose, this component aims to attract (international) concessional finance to further increase the number of funding in new construction (including through the PPP scheme under consideration of MUD according to the 2014 Action Plan) and to the public buildings to be rehabilitated incorporating the energy efficiency requirements.

Despite the 58% energy saving and climate change mitigation potential, an average of $200 million is being invested in public and social housing buildings without concern for energy efficiency due to poor legal gaps and poor enforcement, lack of awareness of the benefits of energy efficiency, limited technical and institutional capacity to pursue change, lack of incentives, etc. The recent Nationally Appropriate Mitigation Action (NAMA) Project developed by UNDP to seek climate finance proposes to leverage grant resources which can cover the incremental cost of energy efficiency investments at the time of major renovation and reconstruction of public buildings, or new construction of public buildings and social housing. The NAMA project is in harmony with the state policy in this sector. As the regulatory section reported, the protocol decision #1504-N of RA Government “On implementation of energy saving and energy efficiency improvement measures in facilities being constructed (reconstructed, renovated) under the state funding" sets the policy requirement for major public investments in urban development to be integrated with energy efficiency.

Table 27. Energy Saving Potential in Public Buildings

Total Area of public buildings in Armenia (m2)	**13,787,397**
Total energy consumption in Public Buildings (MWh/year)*	1,764,787
Annual Energy Saving Potential (MWh/year)*	896,181
** - based on R2E2 experience with 56 projects.*	
Average energy consumption prior to EE in public buildings	128 kWh.m/yr
Average energy consumption after EE	63 kWh.m/yr
Average energy saving rate	51%
Investment need (AMD) at average of AMD 8400/m2 for typical ESMs	115,814,134,238
Investment need (USD) - exchange rate 473	$244,850,178
Total Financing currently available (GEF and KfW)	$ 27,270,296

Source: National Statistical Service

Despite the above large energy saving potential that is availabe in the public buildings, the operational scheme for energy saving agreements offered by the R2E2 has strict eligibility criteria and can cover only a fraction of all public/municipal institutions interested in reducing their energy costs. The current eligibity criteria have put at least 100 appications in the rejection list. Considering the limitations of the current lending scheme it is important that an alternative financing mechanism is worked out to address the energy efficiency investment needs in those 200 public institutions. From the full NSS databank of Armenia's all public buildings, the average public building size is 3292m^2. Overall, the unserved demand for energy efficiency retrofits for these indicative 658,000m^{2}comprises $11,851,806, and has energy saving potential of

This is particularly important because the submission of the application to R2E2 indicates the political will and readiness of the management in these institutions to commit to energy efficinecy improvement measures, loan repayment, etc. To favor this positive trend, the E5P project idnetification mission has proposed an alternative lending scheme with grant co-financing to supplement the R2E2 credit line for public building EE. The alternative conditions proposed were as follows :

- Comfort level > 40% (instead of the current "> 50%", because studies show that an average public building has a comfort level of 35%, which makes many perfectly good project ineligible)
- Estimated energy savings > 20%
- NPV >0
- Simple payback < 10 years
- Investment > $ 50 000

Expansion of acting R2E2 credit line for public and municipal building energy efficiency retrofits under energy performance contracting scheme. It is proposed to expand the credit line to include approximately 100 projects (each project usually covers one municipal/public building or

a street-lighting system) which have not met the eligibility criteria of the GEF-funded credit line.

Typical measures to include:
1. Insulation of walls and roofs,
2. replacement windows and doors
3. replacement of street-lighting systems,
4. Heating system replacement/upgrade
5. Replacement of windows by walls

4.2.2 Street-lighting

Urban lighting costs of Armenian municipalities account for more than **USD 5 million per annum** (power costs and maintenance). The capital city of Yerevan has the largest energy consumption and saving potential in its lighting sector: it accounts for **approximately 80 percent** of all urban lighting energy use in the country.[29]

Table 28. Municipal street-lighting systems in RA

Indicators	Yerevan	Other cities
Number of illuminated objects	**1235**	**981**
Number and type of street lights	**54880**	**7450**
High pressure sodium 150W/250W	*50785*	*7450*
Mercury (250W)	*2000*	*3734*
Mercury (400W)	*700*	*2740*
CFL	*0*	*110*
LED and halogen	*229*	*0*
Total installed capacity of street lighting system, MW	**15**	**4**
Annual electricity consumption for 2011, mln kWh/year	**31,3**	**8,7**
Annual electricity costs for 2011, mln USD/year	**1,99**	**0,6**
Average daily length of operation of street lighting, hours	**8**	**6,44**
Annual GHG emissions, street lighting systems, tCO_2/year	**12500**	**3500**

Source: UNDP-GEF

Several financiers have addressed energy efficiency improvements in municipal street-lighting:
- R2E2 has been providing 10 loans to municipalities with over $212,000 in investments via energy saving agreements (ESAs) in cooperation with contracted ESCOs with energy saving rate of 34-58% for Vayq, Dilijan street-lighting through 368 new light sources.
- UNDP-GEF Green Urban Lighting Project introduced about 500 LED lights to Isakov Avenue,Tairov street, as well as Yerevan Zoo and street lighting pilot in Alaverdi city The initiative, which was carried out in partnership with the Ministry of Nature Protection and Yerevan Municipality, allows energy savings of 63 percent, reduction of costs by USD

[29] Source: http://www.am.undp.org/content/armenia/en/home/operations/projects/environment_and_energy/green-urban-lighting.html

45,000, and carbon emissions by 220 tons per year. The project has just launched in 2013 and will continue until 2017.[30]

- EBRD signed Yerevan Municipal Street lighting loan with the Armenian Government for 28 pilot streets for EUR 6 million of which EUR 2 million will be covered from the E5P grant facility.

All the individual measures related to buildings sector were presented either in the regulatory / cross-cutting section, or in the financing section above. Considering the overall commercial viability of energy efficiency investments in the street-lighting sector, no new activities are proposed by the NEEAP. The R2E2 energy efficiency credit line for public buildings also finances street-lighing projects and the available loan funding can be adequate to address the demands of other local governments for energy efficiency retrofits in public stree-lighting systems. These measures are also cross-cutting with the Covenant of Mayors initiatives.

The below summary table provides a summary overview of all described measures in public buildings and streetlighting, followed by individual activity tables.

[30] Source: http://www.am.undp.org/content/armenia/en/home/presscenter/pressreleases/2015/03/27/almost-500-new-energy-efficient-leds-installed-along-isakov-avenue-and-tairov-street/ and data provided by Project team.

Table 29. Summary of EE Improvement Measures in Public Buidling and Streetlighting

No	Title of the energy saving measure	End-use targeted	Duration	Achieved energy savings per year (MWh)				Status in relation to 1st EEAP
				2014	2017	2018	2020	
III.1.	Public Building EE: Implementation of energy saving activities in municipal and social public facilities (R2E2/GEF/WB)	Implement energy saving activities in public facilities to reduce the level of energy consumption by social and other public facilities under energy saving agreement (ESA) scheme with ESCO participation.	Start: 2012 End: 2017	401	521	521	521	partially completed
III.2.a	Public Building EE: Grant-cofinanced Implementation of energy saving activities in municipal and social public facilities (E5P/R2E2/GEF/WB)	Expand the current R2E2 lending facility to implement energy saving activities in public facilities to reduce the level of energy consumption by social and other public facilities, which have suboptimal comfort levels in status quo.	Start: 2016; End: 2020	new measure	4,214	5,057	7,585	new measure
III.2.	NAMA project to Support Energy Efficinecy in Public Buildings and Social Housing	New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2016 End: 2020 (ongoing)	new measure	11,442	14,653	21,037	partially completed
III.3.	Financing for EE & Public Procurement for EE: UNDP Green Urban Lighting Project GHG Emission reduction by increasing energy efficiency of municipal lighting in the cities of Armenia	Municipal lighting electricity use in the cities of Armenia	Start:2013 End: 2017	new measure	47	47	47	partially completed
III.4.	Energy Efficiency -integrated reinforcement of Schools by KfW (and potentially ADB)	Public & service buildings (schools)	Start:2016; End: 2020	new measure	39,897	39,897	39,897	pending
III.5.	EBRD Loan-funded Yerevan streetlighting	Municipal lighting electricity use in 49 streets of Yerevan, Armenia	Start: 2015; End 2017	new measure	1,277	1,277	1,277	pending launch
III.6.	USAID Clean Energy and Water Program for EE & RE solutions in community energy and water use	rural communities, agricultural water users, community organizations, municipalities	Start: 2012	19	19	19	19	completed
Sum of savings:			**MWh**	420	57,417	61,470	70,382	
Sum of savings:			**KTOE**	0.04	4.94	5.29	6.05	

4.3 Agricultural Sector

The use of energy in the agricultural sector has been growing over the past two decades. Although this has been accompanied by growth of the gross agricultural product (GAP), energy use has increased at a significantly faster rate than has GAP since 2011. As a result, the energy intensity of agricultural output has increased, leading to higher net energy use per unit of output. This is largely due to inefficient machinery (e.g., pumps) and irrational irrigation water use (e.g., over-irrigating), as well as the transition from largely manual agricultural practices to more technology- and machinery-driven practices. According to the Ministry of Agriculture (MoA) of the Republic of Armenia, 93% of existing agricultural machinery originated during Soviet times and is technologically obsolete. Figure 30below illustrates these trendsin agricultural energy consumption and GAP during 2010-2012.

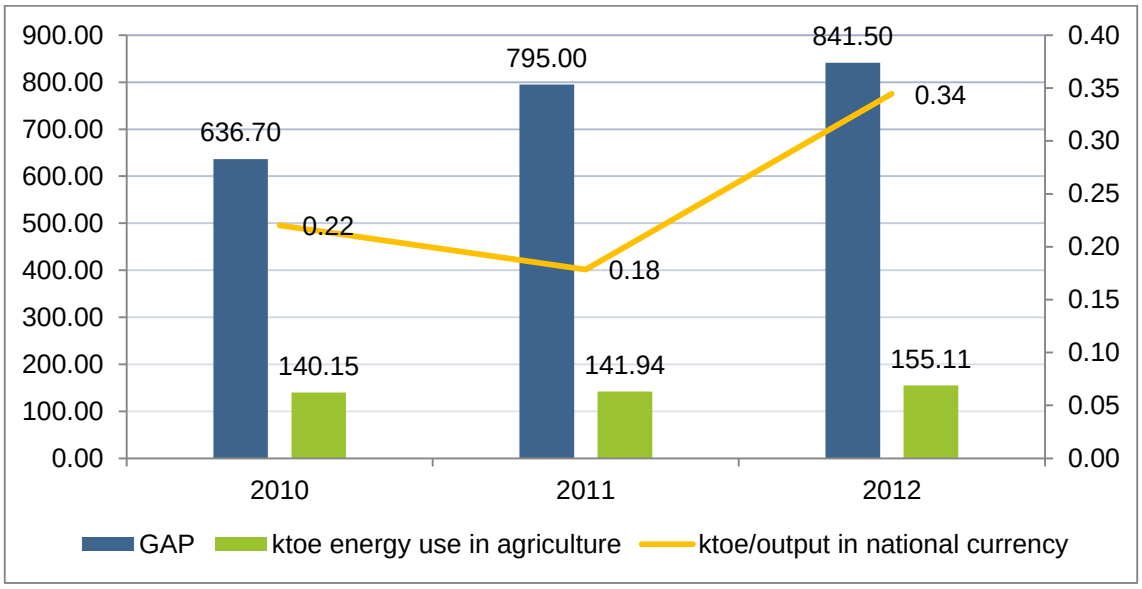


Figure 30. Energy Intensity of Gross Agricultural Output, 2010-2012

The share of total national energy consumption accounted for by agriculture since 2010 has ranged from 6.6% to 8.5% (See Figure 2), but has been growing steadily since 2011. Theenergy

consumed in this sector is largely in the form of natural gas and motor fuels; the agricultural sector accounts for only 2% of total final electricity consumption.

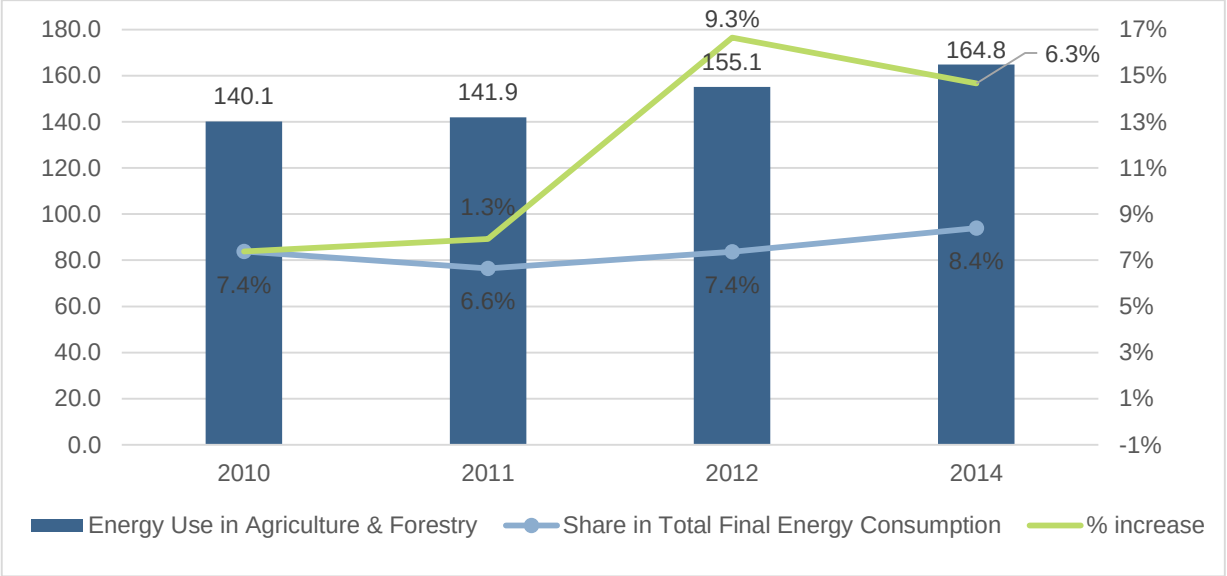


Figure 31. Dynamics of energy consumption in agricultural sector (energy use for 2010-2012 from EC-LEDS Energy Balance, for 2014 – authors' own calculations based on PSR & NSS data)

Armenia's agricultural policies are driven by the government's Strategy for Sustainable Rural and Agricultural Development for the period 2010-2020 (published in 2010). The Strategy specifies the key directions for Armenia's policy in the agriculture sector, defines sectorial priorities, and identifies preferred areas of specialization for higher sustainability, as well as social and economic indicators. The Strategy sets the following targets that affect agricultural energy use:

- The volume of agricultural production in 2020 will exceed the 2007-2009 average level by 64%
- Total area of cropland will increase by 39%
- Areas under fodder crops will increase by 58%, and perennial plantings by 38%
- Livestock population will increase (large animals by 10.4%, sheep and goats by 62%, pigs by 45%, and poultry by 46%); livestock productivity will also increase through improvements in pedigree stock breeding, feeding and farming practices.

The strategy also envisages the consolidation of farms and development of agrarian cooperatives, the improvement of credit, the development of risk mitigation measures, the development of organic agriculture, efforts to reduce vulnerability to climate change, and the development of social infrastructure in rural communities.

As noted, the growth in energy consumption in the agricultural sector has been largely attributed to the aging fleet of agricultural machinery, and the transition from manual processes to machine-

driven agricultural processes (with new machinery added even before the old fleet is phased out). In addition, there has beensignificant growth in the greenhouse industry as well as increasing irrigation demand to meet the growing demand for agricultural crops and an increasing amount of aquaculture (fish nurseries). Thus, these sub-activities of the agricultural sector are the focus of the agricultural section of the second NEEAP.

Table 30. The current status of agricultural machinery in Armenia

	Existing Unit	Working Order	Working Level
Tractors	15,025	11,862	78.9%
Trucks	15,063	11,383	75.6%
Combine-Harvester	1,356	1,007	74.3%
Tractor Trailer	6,130	5,337	87.1%
Tractor Mowing Machines	2,031	1,714	84.4%
Forage Harvester	405	295	72.8%
Grain Cleaning Machines	425	362	85.2%
Row Sowing Machines	1,863	1,597	85.7%
Tractor Plows	3,903	3,447	88.3%
Cultivators	2,279	1,926	84.5%
Square Baler	1,664	1,397	84.0%

Source: NSS
Note: Based on interviews with Head of the State Inspectorate Vardan Ghushchyan, around 93% of existing agricultural machinery was produced in the Soviet Union (during 1976-1991) and is obsolete. The remaining 7% (885 different models of tractors) has been imported, financed largely by grants from IFIs, donors and the Armenian Government.

The greenhouse subsector has grown dramatically, from only 5 hectares in 2011 to 114 ha in 2015, and this growth trend is projected to continue. By 2020,Armenia is expected to have 634 ha of commercial greenhouses – a growing industry, with growing energy demands; even the smaller greenhouses built in 2010-2012 consume over 3.5 million $m^3$of natural gas per hectare. Natural gas consumption thus almost doubledin this sector during 2010-2012 (See Figure 32). Considering the expected expansion of the horticulture sector in Armenia and the energy intensity of this field, improving the efficiency of energy use in existing greenhouses as well as in planned greenhouse designs is of critical importance. According to the data reported by the private sector, modern design and economies of scale for greenhouses can deliver ten times the output using the same energy use. Thus, if the greenhouse industry receives technical assistance and favorable financing, technological upgrades of existing greenhouses as well as intelligent design

of new greenhouses can significantly reduce the rate of growth in energy use of this sector,enabling the sustainable growth of commercially viable and cost-competitive greenhouses.

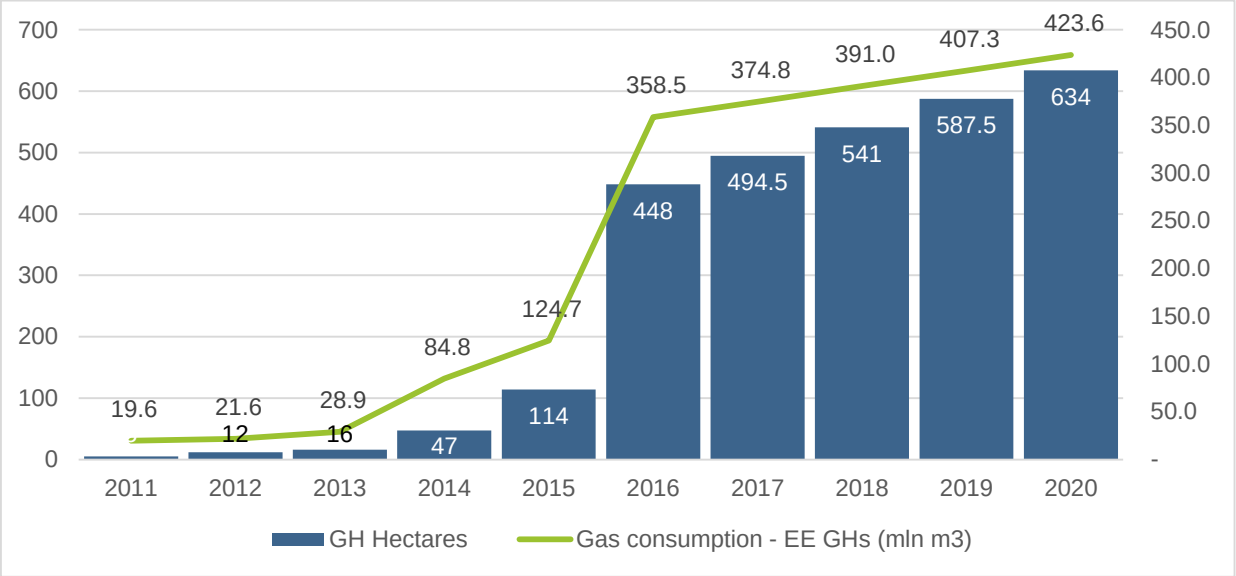


Figure 32. Natural Gas Consumption in the Greenhouses and hectares of Greenhouses in 2010–2012

(Source: Armenian Harvest Promotion Centre CJSC, ArmRusGas)

Another emerging sector is cultured fish production – aquaculture in fish nurseries.[31]A Food and Agricultural Organization of the United Nations (FAO) study has estimated that, as of 2011,Armenia's total annual fish production is 5,000–5,500 tons from 233 fish farms occupying about 2,720 hectares. This sector is also growing rapidly. Since regulations now require that fish farms circulate the deep-water well groundwater that they extract for fisheries, the electricity use in this sector is expected to increase dramatically. To mitigate the energy impact of this practice, it will be necessary to develop and implement energy efficiency solutions for cultured fish production technology. A case study by the Regional Environmental Center revealed significant potential for energy resource efficiency in one of the operating fisheries sized 31.5 hectares: Almost 200 MWh of electricity can be saved annually.just by upgrading the air compression and conditioning technology. This represents a 17% reduction in energy costs associated with fish production at this site. It is noteworthy that these energy efficiency measures also improve the feeding efficiency and productivity of the fishery overall. Considering the growing significance of this sector in Armenia, providing fish nurseries with technical assistance and access to affordable finance should be a priority.

It is important to note that energy solutions in the fisheries subsector overlap with those inthe industrial sector, considering the industrial scales of many fisheries enterprises as well as the further processing and packaging of raw fish into ready food products. The proposed activities for the industry sector related to ISO 50001, resource efficiency and clean production and introduction of best available technologies are thus relevant for the fisheries sector and should be included in proposed measures for aquaculture/fish nurseries.

Since 2010, when the first NEEAP was developed, the Government of Armenia and a number of donors and IFIs have implemented a wide range of programs that have implicitly or explicitly delivered energy efficiency measures to the agricultural sector. These programs have included improvement of irrigation networks and water supply facilities, upgrading machinery and equipment, modernization of aquaculture and greenhouses to serve the broader objectives of

[31] Source: FAO Study. Available at http://www.fao.org/docrep/014/i2103e/i2103e00.pdf

supporting rural communities, and increasing the sector's productivity and competitiveness. Some of these measures have been aimed directly at improving energy efficiency in agriculture; others havehelped improve the sector's energy efficiency indirectly. The main financiers of these projects have been international organizations and the Government of Armenia. The private sector also contributes significant investments to the sector, mainly for aquaculture and greenhouses.

Table 1 summarizes related activitiesimplemented as part of the first NEEAP, as well as new measures proposed for the second NEEAP to help accelerate the introduction of efficient energy and water use in the agricultural sector. It is noteworthy, that the second NEEAP team has identified a substantially larger portfolio of programs and projects in the agrcultural sector, which can assumed to have a significant energy and water sector impact with great certainty. However, due to the lack of reporting and basic metrics available from these activities, it was not possibly to assess their impact on the sector's energy consumption to date or expected impact until 2020. These initiatives, however, have been documented and filed in the second NEEAP for further tracking within the consecutive NEEAPs.

Table 31. Summary of EEIMs in Agriculture

No	Title of the energy saving measure	Description	Target end-use	Time-frame	Achieved energy savings in target year (MWH)				Status in relation to 1st NEEAP
					2014	2017	2018	2020	
VI.1	Rural development program: high efficiency agricultural machinery import	Since 2013 after negotiations with the Republic of Belarus, 288 comparatively affordable wheeled tractors MTZ -82.1,40 units plow L-108, 20 units square baler PT-165M, 2 units precision seed sower SPCH-6LT,4 units potato Planting machine L-201,19 units potato digger KTN-2V,8 units hoe L-131-7, 15 units lawn mowers -2.1 and 6 units universal pneumatic seeder SPU-4d were imported through SMEDNZ,	Farmers	Start: 2013 End: Ongoing	9.4	9.4	9.4	9.4	
VI.2	Importing high efficiency tractors, Japanese ODA	Since 2010 Japan Government through the program Official Development Assistence provided to Armenian Government 171 tractors and spare parts had been imported.	Farmers	Start: 2010 End: 2012	1,267	1,267	1,267	1,267	
VI.4	Irrigation rehabilitation emergency project, WB	The Project Development Objectives were to: (i) improve water use efficiency in two selected irrigation schemes; and (ii) foster immediate rural employment.	Rural irrigation users;	Start: 2009 End: 2013	77.6	73.3	73.3	73.3	
VI.6	Municipal water project, WB	The Project Development Objective is to support improvement of the quality and availability of water supply in selected service areas of the Armenian Water and Sewerage Company. Total project Cost 18m. The activities envisaged under the Project will bring direct benefits to about 133,000 AWSC service consumers in three selected cities identified for the Project interventions, i.e. Ashtarak, Masis and Echmiadzin and neighboring rural settlements.	Rural irrigation users; farmers	Start: 2012 End: 2015					

No	Title of the energy saving measure	Description	Target end-use	Time-frame	Achieved energy savings in target year (MWH)				Status in relation to 1st NEEAP
					2014	2017	2018	2020	
VI.7	USAID Clean Energy & Water Program	1) The Berkaber Village Water Supply Project will improve the community's water network through the installation of modern, loss-less polyethylene piping, the introduction of water metering infrastructure and practices, and the repairing of the network's intake/catchment facility. 2) The Lukashin Village Water Supply Project will improve the community's water network through the installation of a new water main, installation of modern, nearly loss-less polyethylene piping, the introduction of water metering infrastructure and practices, and the addition of a new pump, and will result in significant water and energy savings. 3) Arazap, a small rural community in the Armavir marz, has access to irrigation water; however, the drinking water was only available 3 hours per day. The project improved the efficiency of the water supply system, reduced the water losses and contamination risks and has led to significant water, energy, and financial savings. Now, instead of just 3 hours, the citizens of Arazap have access to clean water 24 hours a day. 4) Improve the village drinking water supply by implementing a combination of measures that allow significant water and energy improvements and in better cost recovery of the water supply services, due to improved billing and collection.	Rural communities	Start: 2013-2014 End: Ongoing	150	150	150	150	

No	Title of the energy saving measure	Description	Target end-use	Time-frame	Achieved energy savings in target year (MWH)				Status in relation to 1st NEEAP
					2014	2017	2018	2020	
VI.10	Irrigation System Modernization and Institutional Capacity Building, WB	On 26 June 2013, the Council of the Anti-Crisis Fund of the Eurasian Economic Community approved the preliminary request and Concept Note for the investment project Irrigation System Modernization and Institutional Capacity Building in Armenia in the amount of US $50 million, with the anticipated contribution of the Fund of US $40 million. The project includes the following components: · Replacement of mechanical irrigation with flow irrigation; · Rehabilitation of main and secondary canals; · Rehabilitation of WUAs' on-farm distribution network; and · Building WUAs institutional capacity and pilot creation of WUAs federation.	Rural irrigation users; farmers	Start: Future plans		19000	19000	19000	
VI.12	Science technology innovation partnership (STIP)	On April 4, 2014 the U.S. Agency for International Development (USAID) Administrator Rajiv Shah announced the establishment of the U.S. Global Development Lab. The U.S. Global Development Lab will support breakthrough solutions in water, health, food security and nutrition, energy, education, and climate change, reaching 200 million people in the next five years. Armenia is selected as one of USAID's twenty lead missions worldwide that will champion science, technology, innovation and partnership (STIP) initiatives. In recent years, USAID has invested nearly $45 million in STIP-related projects in Armenia, particularly in the sectors of high technologies, energy and water, governance, and health care.	Fish farms	Start: 2014 End: 2030					

No	Title of the energy saving measure	Description	Target end-use	Time-frame	Achieved energy savings in target year (MWH)				Status in relation to 1st NEEAP
					2014	2017	2018	2020	
VI.13	Energy efficient greenhouse	Armenian Harvest Promotion Centre cooperating with the Government of Armenia is planning to expand the greenhouse area to reach at least 500 ha of large industrial greenhouses in 2020.	Private greenhouse sector	Start: 2011 End: 2020		425	480	591	
VI.15	Grading agricultural products based on quality	Creating mechanisms for grading agricultural products based on quality for the processing industry. This is especially important for the grape processing sector. This will focus farmers' attention on the proper agro management, which in turn means providing adequate volume of water to the plants.	Processors, farmers	Start: Immediately End: 2020		8620	25900	51700	
VI.16	Renewing the agricultural machinary park	Most of the agricultural machinery equipment is in the private hands. These owners are established service providers in their communities. However, they do not generate sufficient funds to replace their old and obsolete machinery with newer equipment. The new equipment tends to be given to the agricultural cooperatives under state or other donor subsidy mechanisms. Usually the cooperative members are small holder growers and are not capable of properly operating and maintaining the equipment. This lack of skills and knowledge drastically cuts the useful life of the equipment.	Farmers	Start: Immediately End: 2020		134	201	269	
VI.18	Install gravity irrigation	Transformation into gravity irrigation will contribute into energy saving, because pumping system installed in Soviet Union periods is very expensive to operate. This action will result to energy saving, for example in 2013 the energy consumption of water supply companies dramatically reduced from 129 watt/hour to 25 watt/hour.	Farmers	Start: Immediately End: 2020	172000	17200	34500	51700	

No	Title of the energy saving measure	Description	Target end-use	Time-frame	Achieved energy savings in target year (MWH)				Status in relation to 1st NEEAP
					2014	2017	2018	2020	
	Total MWH				1,508	19,223	19,223	19,223	
	Total ktoe				0.13	1.65	1.65	1.65	

The above tablealso presents the new measures and policy/program recommendations, which can help slow down the rate of increase in energy intensity of agriculture, while helping improve the productiveness of the sector. These included the following programs:

- Rural development program brought Government support in negotiations and import of288 units of high efficiency agricultural machinery
- Operational Development Assistance from Japanese Government supported importing 171 high efficiency tractors;
- The World Bank implemented several rural and community development programs aimed at irrigation system enhancement, emergency irrigation rehabilitation, community agricultural resource management and competitiveness, as well as municipal water supply. The WB also plans to launch a new program aimed at Irrigation System Modernization and Institutional Capacity Building with a complex portfolio of irrigation improvement projects.
- USAID through its Clean Energy and Water Project supported water supply improvements in Berkaber, Lukashin, Arazap villages, potable water supply project in Hartavan village;
- The GEF Small Grants Program supported Parakal community decentralized wastewater treatment,
- Water supply and sanitation sector project
- Agriculture and rural development, ENPI, ADA
- Science technology innovation partnership (stip)
- Energy efficient greenhouse
- Farmer education on irrigation management
- Grading agricultural products based on quality
- Renewing the agricultural machinary park
- Establishment of agricultural groups/cooperatives
- Install gravity irrigation

Considering The international best practices in the context of Armenian agriculture, the following measures need to be implemented in order to further improve the energy efficiency and competitiveness of the agricultural sector:

- Addressing the problem of regular electricity supply at relatively low cost through effective use of solar, land, underground, water energy alternatives in mountainous and border villages.

- Farmer education on irrigation management: Many of the farmers in Armenia over-irrigate their plots considering the abundance of water a positive impact for the plants and trees. This practice is counter-productive and even damaging for many plants, including apricot trees and grape vineyards. Education of farmers is necessary on sustainable irrigation practices, which will not only help optimize the water use and improve harvest productivity, but also save substantial amounts of energy.

- Continue the modernization of the agricultural machinery and equipment park as well as the equipment park database management, as 92% of current tractors and 80% of

combine harvesters are more than 25 years old. Most of the agricultural machinery equipment is in the private hands. These owners are established service providers in their communities. However, they do not generate sufficient funds to replace their old and obsolete machinery with newer equipment. The new equipment tends to be given to the agricultural cooperatives under state or other donor subsidy mechanisms. Usually the cooperative members are small-scale holder/growers and are not capable of properly operating and maintaining the equipment. This lack of skills and knowledge drastically cuts the useful life of the equipment. If the trend continues, there will be a serious risk of losing the cadre of the community tractorists. So, there should be a program directed to these individuals or the cooperatives should be encouraged to integrate the community mechanizators into their group.This activity should be integrated with the continued establishment of agricultural groups and cooperatives, which generally contributes to the scale effects of grouping smaller producers and harvesting benefits from shared access to cost-intensive technical solutions.

- Meanwhile the current database of the agricultural machinery lacks quality information and is poorly managed. To be able to support and track the effect of the fuel-efficient technology adaptation in the country, one needs to have access to indicators on the use of existing modern equipment is being utilized in the country. This data is not available at this stage. One of the ways to improve the registration system is implementation of a general system of agriculture administrative register.

- Continue focusing on the gravity irrigation programs:The pumping system inherited from Soviet Union is too expensive to operate. In order to avoid huge costs of inefficient electricity use in those systems the gravity irrigation system needs to be installed where possible.

- Focus on waste water collection and waste management in general:There are 20 factories, which are engaged in wastewater cleaning. However, those factories are inefficient, physically and morally obsolete. Investing in new technologies directed to wastewater cleaning will substantially improve the energy use of this sector, as well as the volumes of water saved.

- Armenia has significant water resources ensuring development of aquaculture. In this context, an important problem is the excess use of water and electricity by this sector. Installation of dissolved oxygen concentration readers inaquaria, allowing working out air-conditioning equipment can be considered as one of the best methods of saving electricity. Within the scope of RECP energy efficiency programs a similar project was implemented in Unifish LLC in 2014. The expected annual energy saving after the project implementation for just one fish farm was194 MW/year (or AMD 7,153,920).

- In order to make the use of agricultural resource potential more effective, a special attention should be paid to promotion of creation of greenhouses in farming entities. The following activities need to be implemented:
    - Provision of tax privileges for import of main equipment and construction materials needed for creation of greenhouses,

- Provision of affordable targeted loans for creation of greenhouses for farmers.

Implemented within the scope of first NEEAP, the energy efficiency projects listed below were/are aimed at mitigating the increase in energy intensity of agriculture.

Title of the energy saving measure		**Rural development program: high efficiency agricultural machinery import**
Index of the measure		**VI.1**
Description	**Category**	Agriculture Machinery
	Timeframe	Start: 2013
		End: Ongoing
	Aim/brief description	Since 2013 after negotiations with the Republic of Belarus, 288 comparatively affordable wheeled tractors MTZ -82.1,40 units plow L-108, 20 units square baler PT-165M, 2 units precision seed sower SPCH-6LT,4 units potato Planting machine L-201,19 units potato digger KTN-2V,8 units hoe L-131-7, 15 units lawn mowers -2.1 and 6 units universal pneumatic seeder SPU-4d were imported through SMEDNZ,
	Target end-use	Farmers
	Target group	Ministry of Agriculture
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are:
		1. Giving farmers new machinery with low rates and cheap prices is intended to help farmers save energy by working efficiently.
	Budget and financial source	Not possible to be determined
		Ministry of Agriculture
	Implementing body	State sector, SMEDNZ, Ministry of Agriculture
	Monitoring authority	
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of vehicles
	Expected savings in 2014 as per 1st EEAP MWH/year	9.4
	Expected savings in 2017 as per 1st EEAP	9.4
	Expected achieved in 2018 MWH/year	9.4
	Expected energy savings in 2020	9.4
	Expected impact on energy savings in 2020 (if available)	9.4

	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Importing high efficiency tractors, Japanese ODA**
Index of the measure		**VI.2**
Description	**Category**	agricultural machinery upgrade, Information and mandatory information measures; Transport specific measures;
	Timeframe **Aim/brief description**	Start: 2010 End: 2012 Since 2010 Japan Government through the program Official Development Assistance provided to Armenian Government 171 tractors and spare parts had been imported.
	Target end-use	Farmers
	Target group	
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Replacement of agricultural machinery
	Budget and financial source	N/D
	Implementing body	Ministry of Agriculture, Japan Government
	Monitoring authority	MoA
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of vehicles,
	Expected savings in 2014 as per 1st EEAP MWH/year	4.7
	Savings achieved in 2014	4.7
	Expected energy savings in 2017	4.7
	Expected energy savings in 2018*	4.7
	Expected impact on energy savings in 2020 (if available)	4.7
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Irrigation system enhancement project, WB**
Index of the measure		**VI.3**
Description	**Category**	Irrigation
	Timeframe	Start: 2013 End: 2017
	Aim/brief description	The Project Development Objectives are (i) to reduce the amount of energy used and to improve the irrigation conveyance efficiency in targeted irrigation schemes; and (ii) to improve the availability and reliability of important sector data and information for decision-makers and other stakeholders.
	Target end-use	Rural irrigation users;
	Target group	Farmers
	Regional application	Regional (Meghri, Gegardalich, Baghramyan-Norakert and Kaghtsrashen)
Information on implementation	**List and description of energy saving actions substantiating the measure**	Key Indicators are the volume of water savings was increased from 97 to 131 million cubic . Rehabilitation of identified stretches of primary canals (US$15.90million) in the selected irrigation schemes. Six schemes were identified for support with approximately 50 km of main and secondary canal sections to be rehabilitated. Rehabilitation of Primary Canals in Talin and Armavir Irrigation Schemes (US$33.08 million). This component financed rehabilitation of 83.81 km of primary canals (main and branch canals) in the Talin and Armavir schemes: 59.01 km of the Talin Irrigation Scheme located in Aragatsotn and Armavir Marzes, as well as 24.80 km of the Armavir Irrigation Scheme located in Armarvir Marz. As the geographic scope of the project was expanded under the Additional Financing, water users in Kotayk, Shirak, Lori, Ararat, and Gegarkunik marzes were brought within the fold of the project and benefited from project interventions. It is estimated that approximately 118,000 water users benefited under the project. meters (MCM) (35 percent increase). Target was subsequently set to reduce seepage losses by 15-16 percent so that by end-of project losses would be 7 percent. Potential increase of total irrigation area as a result of rehabilitation works on main/secondary canals from 28,275 ha to 83,210 ha. Rehabilitation of on-farm irrigation network (US$4.02 million) would rehabilitate selected tertiary canals. Restored irrigation area in communities with rehabilitated tertiary network is 704 ha. Nineteen communities of Lori, Shirak, Gegharkunik and Armavir marzes would benefit from improved water conveyance over about 2,500 hectares.
	Budget and financial source	$ 33,100,000.00

	Implementing body	Ministry of Agriculture, State Sector
	Monitoring authority	World Bank
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of project Changed Irrigation Pipes
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	
	Expected energy savings in 2017	
	Expected energy savings in 2018*	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Irrigation rehabilitation emergency project, WB**
Index of the measure		**VI.4**
Description	**Category**	Irrigation
	Timeframe	Start: 2009 End: 2013
	Aim/brief description	The Project Development Objectives were to: (i) improve water use efficiency in two selected irrigation schemes; and (ii)foster immediate rural employment.
	Target end-use	Rural irrigation users;
	Target group	Farmers
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Key Indicators are the volume of water savings was increased from 97 to 131 million cubic . Rehabilitation of identified stretches of primary canals (US$15.90million) in the selected irrigation schemes. Six schemes were identified for support with approximately 50 km of main and secondary canal sections to be rehabilitated. Rehabilitation of Primary Canals in Talin and Armavir Irrigation Schemes (US$33.08 million). This component financed rehabilitation of 83.81 km of primary canals (main and branch canals) in the Talin and Armavir schemes: 59.01 km of the Talin Irrigation Scheme located in Aragatsotn and Armavir Marzes, as well as 24.80 km of the Armavir Irrigation Scheme located in Armarvir Marz. As the geographic scope of the project was expanded under the Additional Financing, water users in Kotayk, Shirak, Lori, Ararat, and Gegarkunik marzes were brought within the fold of the project and benefited from project interventions. It is estimated that approximately 118,000 water users benefited under the project. meters (MCM) (35 percent increase). Target was subsequently set to reduce seepage losses by 15-16 percent so that by end-of project losses would be 7 percent. Potential increase of total irrigation area as a result of rehabilitation works on main/secondary canals from 28,275 ha to 83,210 ha. Rehabilitation of on-farm irrigation network (US$4.02 million) would rehabilitate selected tertiary canals. Restored irrigation area in communities with rehabilitated tertiary network is 704 ha. Nineteen communities of Lori, Shirak, Gegharkunik and Armavir marzes would benefit from improved water conveyance over about 2,500 hectares.
	Budget and financial source	$ 36,220,000.00
	Implementing body	Ministry of Agriculture, State Sector, World Bank

	Monitoring authority	World Bank
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of project Changed Irrigation pipes Rehabilitated canals
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014* MWH	77.6
	Expected energy savings in 2017	73.3
	Expected energy savings in 2018*	73.3
	Expected impact on energy savings in 2020 (if available)	73.3
	Assumptions*	/
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Community agricultural resource management and competitiveness project, WB**
Index of the measure		**VI.5**
Description	**Category**	Irrigation, Pasture
	Timeframe	Start: 2011 End: 2016
	Aim/brief description	The project development objective is to improve productivity and sustainability of pasture/livestock livelihood systems in selected communities. This would be evidenced by: (i) increased livestock productivity as measured by milk productivity and increase in daily animal weight gain; (ii) increased efficiency of communal pasture management, as measured by increased communal budgetary revenues from lease of pastures; (iii) increased farm sales from livestock; and (iv) increased Pasture Management Effectiveness.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	National

Information on implementation	**List and description of energy saving actions substantiating the measure**	As a result of project interventions, milk productivity both for cattle and sheep have increased by 22.4% and 15% respectively as compared with the end project targets of 20% and 10% (from 1,428 kg/year to 1,748 kg/year for cattle and from 66 kg/year to 76 kg/year for sheep). Similarly, the growth rates of animals for cattle and sheep have increased by 18% and 16% respectively against the end project targets of 20% and 5%. Efficiency of communal pasture management as measured by increased communal budgetary revenues from lease of pastures has increased by 58.5% compared with the end-target of 30%. Sales from livestock have increased by 133% vs. planned mid-term of 10% and end-project 20%. A total of 83 communities have established and registered Pasture User Cooperatives (PUCs) and developed their Pasture Management and Livestock Development Plans (PMLDP) (28 more than originally planned). In addition 6 more communities have registered PUCs, which will be supported with potential savings or with funds provided under CARMAC II. Construction works of pasture watering systems are: (a) completed (165 km waterline, 205 watering points) in 63 communities, (b) under implementation in 8 communities (18 km waterline, 18 watering points) and (c) in the stage of design in 2 communities (12 km waterline, 8 watering points). Some 545 units of agricultural machinery, including 124 wheeled tractors, 80 baling machines and 341 units of other agricultural tools have been provided to the PUCs of 70 communities. Two communities have implemented some 160ha of cultivated fodder production supported under the Project and most of the other communities plan to use the provided machinery to cultivate fodder with subsidized inputs from the government program. In 2014, this agricultural machinery and equipment generated AMD 9.3 million in income for the MASCs and AMD 3.0 million for the RASC.
	Budget and financial source	
	Implementing body	Ministry of Agriculture, State Sector, World Bank
	Monitoring authority	World Bank
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of project Irrigation canals
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	

	Expected energy savings in 2018*	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		***Municipal water project, WB***
Index of the measure		**VI.6**
Description	**Category**	Irrigation
	Timeframe	Start: 2012 End: 2015
	Aim/brief description	The Project Development Objective is to support improvement of the quality and availability of water supply in selected service areas of the Armenian Water and Sewerage Company. Total project Cost 18m. The activities envisaged under the Project will bring direct benefits to about 133,000 AWSC service consumers in three selected cities identified for the Project interventions, i.e. Ashtarak, Masis and Echmiadzin and neighboring rural settlements.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Weighted average daily supply of drinking water service in selected areas (Hours, Custom) from 12.30 hours in beginning of project(2012) increased to current indicator 16.82 hours (2015). The weighted average non-revenue water in selected areas (Percentage, Custom) baseline was 83.5%,actual number decreased to 81%. As part of the water network rehabilitation, the project is replacing main water pipes in the selected areas. While most of the network rehabilitation and pipe replacement is completed, the individual connections to households are yet to be completed. The water is still being delivered to the customers through the old deteriorated pipes until the household connections are done. This explains the high level of non-revenue water. This indicator is expected to drop to realistically reflect the actual NRW. The measurement will be taken in end June 2015 and reported in the final ISR. Number of people in rural areas provided with access to improved Water Sources under the project (Number, Custom), the baseline was 21,400 users, actual increased to 31,089 users, moreover expected target number during program closing is 33,328 The water production (liter per capita per day) (Number, Custom) initially was 752L, currently it have decreased to 484l. Number of automation systems installed at pumping stations and daily regulation reservoirs (Number, Custom) 48.
	Budget and financial source	

	Implementing body	Ministry of Agriculture, State Sector, World Bank
	Monitoring authority	World Bank
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Efficiency of project
		Electricity consumption
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	
	Expected energy savings in 2018*	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**USAID Clean Energy & Water Program**
Index of the measure		**VI.7**
Description	**Category**	Irrigation
	Timeframe	Start: 2013-2014 End: Ongoing
	Aim/brief description	1) The Berkaber Village Water Supply Project will improve the community's water network through the installation of modern, loss-less polyethylene piping, the introduction of water metering infrastructure and practices, and the repairing of the network's intake/catchment facility. 2) The Lukashin Village Water Supply Project will improve the community's water network through the installation of a new water main, installation of modern, nearly loss-less polyethylene piping, the introduction of water metering infrastructure and practices, and the addition of a new pump, and will result in significant water and energy savings. 3) Arazap, a small rural community in the Armavir marz, has access to irrigation water; however, the drinking water was only available 3 hours per day. The project improved the efficiency of the water supply system, reduced the water losses and contamination risks and has led to significant water, energy, and financial savings. Now, instead of just 3 hours, the citizens of Arazap have access to clean water 24 hours a day. 4) Improve the village drinking water supply by implementing a combination of measures that allow significant water and energy improvements and in better cost recovery of the water supply services, due to improved billing and collection.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	Regional
Information on implementation	**List and description of energy saving actions substantiating the measure**	Reduction in energy use by installing gravity irrigation, Reduction in water losses by installing new pipelines
	Budget and financial source	$ 265,803.00
	Implementing body	Ministry of Agriculture, State Sector, World Bank
	Monitoring authority	USAID
Energy saving	**Method for monitoring/measuring the resulting savings**	Energy Saving of project Number of beneficiaries: 5,641residents

Expected savings in 2014 as per 1st EEAP	149.82
Savings achieved in 2014	149.82
Expected energy savings in 2018*	149.82
Expected impact on energy savings in 2020 (if available)	149.82
Assumptions*	
Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Parakar Community Decentralized Wastewater Treatment, GEF Small Grant**
Index of the measure		**VI.8**
Description	**Category**	Irrigation
	Timeframe	Start: 2010 End: Ongoing
	Aim/brief description	March 2010, the Global Environment Facility's (GEF) Small Grants Program (SGP) in Armenia supported the initiative of the Parakar community administration to address the issue through application of a low-cost, decentralized wastewater treatment system as a simple local solution. The initiative was aimed to rehabilitate community farmlands through application of lagoon type biological ponds for domestic wastewater treatment. The technology allows treating the household wastewater to the quality required for irrigation, while using the naturally treated effluents.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	Regional
Information on implementation	**List and description of energy saving actions substantiating the measure**	It was estimated that after the project implementation 100 hectares of degraded lands will be restored and penetration of about 12 tons of nitrogen and 6 tons of phosphorus into the groundwater aquifer will be prevented. About 45 households of the community will gain an average USD 700-1,200 annual income, depending on the cultivated crop.The community administration plans to provide the treated wastewater to the most vulnerable groups for irrigation at a lower price. It will result in expansion of cultivated farmlands by about 7.2 hectares.
	Budget and financial source	$ 220,000.00
	Implementing body	Ministry of Agriculture, State Sector, USAID
	Monitoring authority	USAID
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Saving of project
		Water Saving
		Number of Beneficiaries
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	
	Expected energy savings in 2017	
	Expected energy savings in 2018	

	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Water Supply and Sanitation Sector Project**
Index of the measure		**VI.9**
Description	**Category**	Energy
	Timeframe	Start: 2012 End: 2017, Ongoing
	Aim/brief description	The Project funds two project components which include: (i) municipal infrastructure rehabilitation and improvement; and (ii) management improvement and development which include gender features. This Component will address the rehabilitation and replacement of the existing water supply infrastructure. Works will include construction of about 600 km of new mains and pipe network to connect about 110,000 new and existing households, rehabilitation of about 5 pumping and about 3 chlorination stations, 1 water treatment plants, about 15 daily regulation reservoirs as well as installation of about 20,000 water meters to commercial and domestic consumers. Further, this component will include the re-designing of the water supply systems.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	Regional
Information on implementation	**List and description of energy saving actions substantiating the measure**	By redesigning the overall WSS systems, this component addresses the existing problems of the systems being overdesigned/under-designed. It also includes updating of consumer databases, conversion of illegal connections to registered accounts, and monitoring of water quality. To demonstrate 100% water supply coverage, 100% metering, 24-hour water supply with the desired pressure, and 100% collection efficiency, the Project will select a pilot zone and concentrate resources to undertake the related actions. This will help gain the confidence of all consumers in the Project area in an efficient and strongly governed WSS system, and help the implementing agency (IA) to replicate it smoothly. Selection of the pilot zone will be based on active participation and strong commitment of the users, apart from technical considerations to isolate the zone hydraulically for the required water pressure after addressing all the water losses.
	Budget and financial source	$ 36,000,000
		ADB Financing
	Implementing body	Ministry of Agriculture, State Sector,ADB
	Monitoring authority	ADP
En		Energy Saving of project

	Method for monitoring/measuring the resulting savings	Water Saving
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	
	Expected energy savings in 2017	
	Expected energy savings in 2018	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Irrigation System Modernization and Institutional Capacity Building, WB**
Index of the measure		**VI.10**
Description	**Category**	Irrigation
	Timeframe	Start: future plans End: ongoing
	Aim/brief description	On 26 June 2013, the Council of the Anti-Crisis Fund of the Eurasian Economic Community approved the preliminary request and Concept Note for the investment project Irrigation System Modernization and Institutional Capacity Building in Armenia in the amount of US $50 million, with the anticipated contribution of the Fund of US $40 million. The project includes the following components: · Replacement of mechanical irrigation with flow irrigation; · Rehabilitation of main and secondary canals; · Rehabilitation of WUAs' on-farm distribution network; and · Building WUAs institutional capacity and pilot creation of WUAs federation.
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	Regional

Information on implementation	**List and description of energy saving actions substantiating the measure**	1.Replacement of Mechanical Irrigation with Flow Irrigation (US $ 14 million); The objective of this component is to reduce the costs related to supply of irrigation water by replacing mechanical irrigation (using pumps) with flow irrigation: Argichi, Amrakits, Akunk, Norabats, Masis, Nor Kharberd, Spitak, Tsav Shikaog, Sarashen, Artamet, Ptghni. As a result of this component implementation, mechanical irrigation systems will be replaced with flow ones for 4,250 ha of land that will generate annual savings of 16 million kWh of electricity or US $ 1.1 million 2.Rehabilitation of Main and Secondary Canals (US $ 5 million); As a result of this component implementation, canals of total length of around 31 km will be restored in Aragatsotn, Armavir, and Kotaik irrigation systems.9,239 ha of land will be connected to reliable water supply. Implementation of this component will generate annual savings of operating costs(US $ 0.15 million) and 11.8 million m3 of water (US $ 0.52 million). 3. Rehabilitation of WUAs On-Farm Distribution Network (US $ 25 million) In some cases, on-farm distribution system is not consistent with existing agricultural needs. Some of these systems can be modified by the introduction of drip irrigation or rain. Under this component, such options will be fully explored and developed for certain areas of the main and inter-farm canals in Ararat, Aragatsotn, Armavir, Syunik, Vayots Dzor, Kotayk and Shirak irrigation systems and Yerevan. As a result of implementing this component, 27,000 ha of land will be connected to reliable water supply. Implementation of this component will annually generate savings of operating costs (US $ 0.30 million), 3.0 million kWh of electricity (US $ 0.21 million), and 38.0 million m3 of water
	Budget and financial source	$ 44,000,000.00
	Implementing body	Ministry of Agriculture, State Sector,EDP, World Bank
	Monitoring authority	EDP, World Bank
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy Saving of project
		Water Saving
	Expected savings in 2014 as per 1st EEAP	

	Savings achieved in 2014	
	Expected energy savings in 2017	19000
	Expected energy savings in 2018	19000
	Expected impact on energy savings in 2020 (if available)	19000
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Agriculture and Rural Development, ENPI, ADA**
Index of the measure		**VI.11**
Description	**Category**	Irrigation
	Timeframe	Start: 2014 End: 2017
	Aim/brief description	The Project will support in: establishment and strengthening of cooperatives, business capacity building, increase of the production volume, product development, technology upgrading, marketing, as well as introduction of best agricultural practices (drip irrigation, etc.) and disaster risk reduction (antihail nets, anti-frost) systems. The Program is financed from the European Neighborhood and Partnership Instrument (ENPI) and consists of three parts: Support to Agriculture and Rural Development, to contribute to efficient and sustainable agriculture and development of rural areas in Armenia, in line with the European Neighborhood Program for Agriculture and Rural Development (ENPARD) approach. (€25 million) Support to Regional Development in Armenia to ensure progress towards the more balanced social and economic development between regions of Armenia. (€10 million) Support for EU-Armenia Agreements to assist key Armenian institutions to implement the Visa Facilitation/Readmission Agreements and the ENP Action Plan, to reinforce Armenia's civil society role to monitor the implementation of the Armenian reform agenda, to strengthen the ability of civil servants, as well as to promote Armenia's participation in EU programs and cooperation with EU agencies. (€6 million)
	Target end-use	Rural irrigation users; farmers
	Target group	Farmers
	Regional application	Regional
Information on ...	**List and description of energy saving actions substantiating the measure**	
	Budget and financial source	€ 41,000,000.00
	Implementing body	Ministry of Agriculture, European Union, ADA
	Monitoring authority	European Union, ADA
Energy ...	**Method for monitoring/measuring the resulting savings**	

	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	
	Expected energy savings in 2017	
	Expected energy savings in 2018	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Science technology innovation partnership (STIP)**
Index of the measure		**VI.12**
Description	**Category**	Technology, energy, water
	Timeframe	Start: 2015 End: 2030 Ongoing
	Aim/brief description	On April 4, 2014 the U.S. Agency for International Development (USAID) Administrator Rajiv Shah announced the establishment of the U.S. Global Development Lab. The U.S. Global Development Lab will support breakthrough solutions in water, health, food security and nutrition, energy, education, and climate change, reaching 200 million people in the next five years. Armenia is selected as one of USAID's twenty lead missions worldwide that will champion science, technology, innovation and partnership (STIP) initiatives. In recent years, USAID has invested nearly $45 million in STIP-related projects in Armenia, particularly in the sectors of high technologies, energy and water, governance, and health care.
	Target end-use	Fish farms
	Target group	aquaculture businesses & SMEs
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Build a simple model to analyze energy, environmental (water), and economic data; populate the model with data specific to Armenian fish farms and micro-hydro technologies; and use the model to analyze at least three micro-hydro technologies applied to at least five Armenian fish farms and weigh the options against E3 factors. The output must be an easy-to-understand matrix of fish farms and micro-hydro technologies ranked by suitability. The model must be simple and accessible. The resulting model and output will be used by USAID Armenia as part of its Advanced Science & Partnerships for Integrated Resource Development (ASPIRED) program Science, Technology, Innovation & Partnerships (STIP) Signature Effort, under which at least two technologies with the objective of increasing energy efficiency and/or renewable energy generation will be developed, piloted, and evaluated.
	Budget and financial source	$3,000,000
	Implementing body	Ministry of Agriculture, USAID
	Monitoring authority	USAID
Energy saving	**Method for monitoring/measuring the resulting savings**	n/a

	Expected savings in 2014 as per 1st EEAP	n/a
	Savings achieved in 2014	n/a
	Expected energy savings in 2017	n/a
	Expected energy savings in 2018	n/a
	Expected impact on energy savings in 2020 (if available)	n/a
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Energy efficient greenhouses**
Index of the measure		**VI.13**
Description	**Category**	Technology, energy, water
	Timeframe	Start: 2011 End: 2020
	Aim/brief description	Armenian Harvest Promotion Centre cooperating with the Government of Armenia is planning to expand the greenhouse area to reach at least 500 ha of large industrial greenhouses in 2020. Today 2 projects of Armenian Harvest Promotion Centre are already in the production phase, they cover 14 ha today with plans to expand to 70 ha by 2016. Additionally, 3 ha started the construction, 150 ha project is in the final negotiation, 126 ha and 150 ha are in the final stage of study. In those greenhouses the main productions currently are tomatoes, cucumbers, radish, and roses. The table in the right represents the greenhouse covered areas since 2010 and the planes until 2020. Utility cost for greenhouse(per m^3/year) Water - 5.61 AMD Gas- 35 AMD Electricity - 10 AMD
	Target end-use	Private greenhouse sector
	Target group	horticulture businesses & SMEs
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Drip irrigation saves 90%-95% of water, the old system saves only 60-70%. The new greenhouse energy saving is estimated to be nearly 60%, compare to old one. Reducing gas consumption per hectare from 1.8 million m3 to 0.35 million m3 for all the new Greenhouses since 2016
	Budget and financial source	$27,000,000
	Implementing body	Armenian Harvest Promotion Centre
	Monitoring authority	Armenian Harvest Promotion Centre
Energy savings	**Method for monitoring/measuring the resulting savings**	1. Energy savings
		2. Water saving
	Expected savings in 2014 as per 1st EEAP	
	Savings achieved in 2014	

	Expected energy savings in 2017	424.78
	Expected energy savings in 2018*	480.30
	Expected impact on energy savings in 2020 (if available)	591.33
	Assumptions*	new energy efficient greenhouse design will be developed and endorsed as a construction code and provided to greenhouse developers as guidance.
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Farmer education on irrigation management**
Index of the measure		**VI.14**
Description	**Category**	Agriculture Education
	Timeframe	Start: 2016 (immediately)
		End: Ongoing
	Aim/brief description	Many of the farmers in Armenia over irrigate their plots thinking that the extra water is good for the plants and trees. This over watering, however, hurts many plants. A vivid example of this is irrigation management of Apricot orchard, which can get easily hurt by too much watering. Moreover, many farmers plant alfalfa (requiring frequent and heavy irrigation) in the in rows of the Apricot orchard. In this case the farmers end up using twice as much water than needed.
	Target end-use	Farmers
	Target group	Ministry of Agriculture, Ministry of Education
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are:
		Inform the farmers about the proper irrigation management to save water and improve the health of the plants. The program can cover planting area for most of fruits (40,200 ha) and grapes (17,500 ha) and could result in about 30% water saving. (http://www.armstat.am/file/doc/99489233.pdf, page 303)
	Budget and financial source	Not possible to be determined
		Ministry of Agriculture
	Implementing body	State sector, Ministry of Agriculture, Ministry of Education
	Monitoring authority	Ministry of Agriculture
Energy savings	**Method for monitoring/measuring the resulting savings**	Reduction of the quantity water used.
	Expected savings in 2017 as per 1st EEAP MWH/year	
	Expected achieved in 2018 MWH/year	

	Expected energy savings in 2020 MWH/year	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Grading agricultural products based on quality**
Index of the measure		**V.15**
Description	**Category**	Agriculture Processing
	Timeframe	Start: 2016 (immediately) End: Ongoing
	Aim/brief description	Creating mechanisms for grading agricultural products based on quality for the processing industry. This is especially important for the grape processing sector. This will focus farmers' attention on the proper agro management, which in turn means providing adequate volume of water to the plants. The current quality inspection is based on acceptable vs. non acceptable qualities. There is no price incentive for the better quality grapes based on the health and sugar content of the grapes. As a result, many farmers over irrigate the vineyards to increase the weight of their produce.
	Target end-use	Processors, Farmers
	Target group	Ag. Processors
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are: 1. Organize the processors and farmers into industry boards to set quality standards and connect the price to the standard.
	Budget and financial source	Ministry of Agriculture Ministry of Economy
	Implementing body	State sector, Ministry of Agriculture
	Monitoring authority	
Energy savings	**Method for monitoring/measuring the resulting savings**	Establishment of quality based grading system. Improved agronomy. Improved irrigation management and reduction of water usage.
	Expected savings in 2017 as per 1st EEAP MWH/year	8620

	Expected achieved in 2018 MWH/year	25900
	Expected energy savings in 2020 MWH/year	51700
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Renewing the agricultural machinary park**
Index of the measure		**VI.16**
Description	**Category**	Agriculture Production
	Timeframe	Start: 2016 (immediately)
		End: 2020
	Aim/brief description	Most of the agricultural machinery equipment is in the private hands. These owners are established service providers in their communities. However, they do not generate sufficient funds to replace their old and obsolete machinery with newer equipment. The new equipment tends to be given to the agricultural cooperatives under state or other donor subsidy mechanisms. Usually the cooperative members are small holder growers and are not capable of properly operating and maintaining the equipment. This lack of skills and knowledge drastically cuts the useful life of the equipment. If the trend continues, there will be a serious risk of losing the cadre of the community tractorists. So, there should be a program directed to these individuals or the cooperatives should be encouraged to integrate the community mechanizators into their group. Replacement of the old tractors with new once would result in 20% fuel savings.
		The current database of the agricultural machinery lacks quality information and is poorly managed. To be able to support and (track the effect of) the fuel efficient technology adaptation in the country, one needs to know how is the existing modern equipment is being utilized in the country.
	Target end-use	Farmers
	Target group	Ag. Mechanizators
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are:
		1. Assist the community mechanizators (tractorists) to aquire new and fuel efficient equipment.
		2. Create a reliable database of the Ag. Machinary in the country.
	Budget and financial source	Ministry of Agriculture
	Implementing body	State sector, Ministry of Agriculture

	Monitoring authority	
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy saving.
	Expected savings in 2017 as per 1st EEAP	134.3
	Expected achieved in 2018	201.4
	Expected energy savings in 2020	268.5
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Establishment of agricultural groups/cooperatives**
Index of the measure		**VI.17**
Description	**Category**	Agriculture Production
	Timeframe	Start: 2016 (immediately) End: 2020
	Aim/brief description	The land and agricultural machinary privatization created a system with hundreeds of thounsands small holder farmers on the one side and a small number of agricultural machinary owners on the other side. The relationship between these two groups is regulated by the market, which in this situation creates loose-loose situation for both groups, because the agricultural fields are usually several kilometers away from the community. On the one side the farmers has to pay extra for the fule for the tractorist to reach the plot and. On the other side the tractorist uses the useful life of the tractor on the roads to reach small land plots. This useful life could have been spent on ploughing, spraying, harvesting, or any other mechanization requesting activities that are so much needed in the fields today. Furthermore, for this trip the tractorists do not recieve payment other than fuel compensation. This extra fuel cost to reach the plots is about 10% of the total fuel cost.
	Target end-use	Farmers
	Target group	Farmers
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are: 1. Establish cooperatives to have joint management of the plots. In addition to saving on fuel to reach the plot, this will create economies of scale and reduce the fuel efficiency in general.
	Budget and financial source	Ministry of Agriculture
	Implementing body	State sector, Ministry of Agriculture
	Monitoring authority	

Energy savings	**Method for monitoring/measuring the resulting savings**	Energy saving.
	Expected savings in 2017 as per 1st EEAP	
	Expected achieved in 2018	
	Expected energy savings in 2020	
	Expected impact on energy savings in 2020 (if available)	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Install gravity irrigation**
Index of the measure		**VI.18**
Description	**Category**	Irrigation Systems
	Timeframe	Start: Immediatley End: 2020
	Aim/brief description	Transformation into gravity irrigation will contribute into energy saving, because pumping system installed in Soviet Union periods is very expensive to operate. This action will result to energy saving, for example in 2013 the energy consumption of water supply companies dramatically reduced from 129 watt/hour to 25 watt/hour. In case if the gravity irrigation is not possible, to establish small renewable energy sources (such as solar) to provide energy to the pumps. Apply modern irrigation methods (such as drip irrigation) and support private sector to introduce this technology for irrigation.
	Target end-use	Farmers
	Target group	Farmers
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	Tasks to be implemented are: 1. Install garvity irrigation, in order to avoid energy spending on pumps 2. Install modern irrigation methods (drip irrigation).
	Budget and financial source	Ministry of Agriculture
	Implementing body	State sector, Ministry of Agriculture
	Monitoring authority	
Energy savings	**Method for monitoring/measuring the resulting savings**	Energy saving.
	Achieved savings in 2014 as per 1st EEAP MWH/year	172000

	Expected savings in 2017 as per 1st EEAP MWH/year	17200
	Expected achieved in 2018 MWH/year	34500
	Expected energy savings in 2020 MWH/year	51700
	Expected impact on energy savings in 2020 (if available) MWH/year	
	Assumptions*	
	Overlaps, multiplication effect, synergy	

4.4 Industry, SMEs and Power

The industry sector a significant energy consumer in the country, at 18% of national final energy consumption in 2012. This sector is expected to grow its energy consumption dramatically reaching 30-31% in the next five years (2015-2020 forecast of the Armenia: Energy Demand Planning). This trend highlights the importance of energy efficiency measures in this sector.

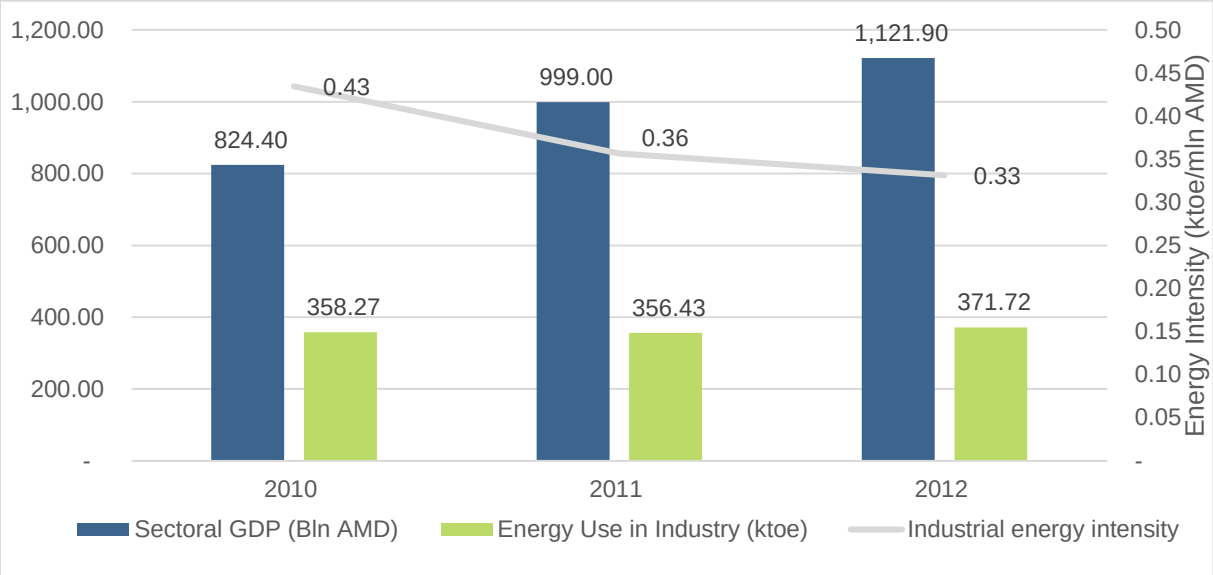


Figure 33. Industrial Energy Intensity Trend, 2010-2012

The analysis of energy intensity of the industrial sector reveals a visible reduction of the energy use per unit of industrial output. This has largely happened due to increasing energy prices and modernization of production technologies (Figure 33).

The structure of energy used in the industrial sectors is presented below.

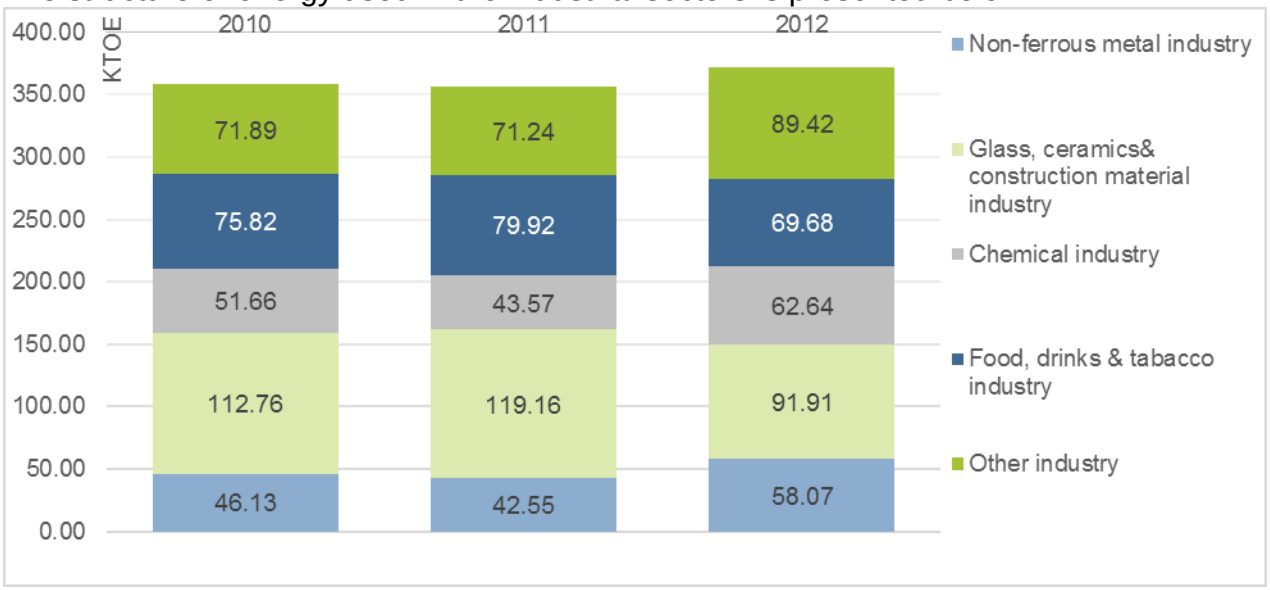


Figure 34 - Industrial Energy Use by Sub-sector, 2010-2012

The industrial energy consumption is largely comprised of electricity and natural gas.

Table 32. Structure of Natural Gas Consumption by Sectors (2011-2013)

	2011	2012	2013	2014	Share in Final Consumption
Quantity of Imported Gas	***2069.1***	***2455.5***	***2361.05***	***2450.9***	(%)
Gas distributed through Networks, including to	1534.92	1608.9	1821.92	2008.8	82%
Population	550.75	542	538.93	515.4	26%
Power Sector	184.91	231.9	252.29	594.1	29.6%
Industry	252.04	259.9	275.261	252.1	12.5%
Vehicle Fueling Stations (CNG)	362.36	418	454.96	481.7	24%
Public Sector	51.45	48.4	49.89	49.1	2%
Other Consumers	133.42	108.7	250	116.3	6%
Average calorific value of natural gas (kCal/m3)				8214	

The industry sector consumes about 18% of all natural gas imported in Armenia Almost 30% of all natural gas is consumed in the power industry for generation of electricity. Furthermore, 20% of all electricity produced in the country is consumed in the industrial sector which is dominated by electric equipment and metal product sub-sectors. The breakdown of electricity consumption by sub-sector is presented in Figure 35.

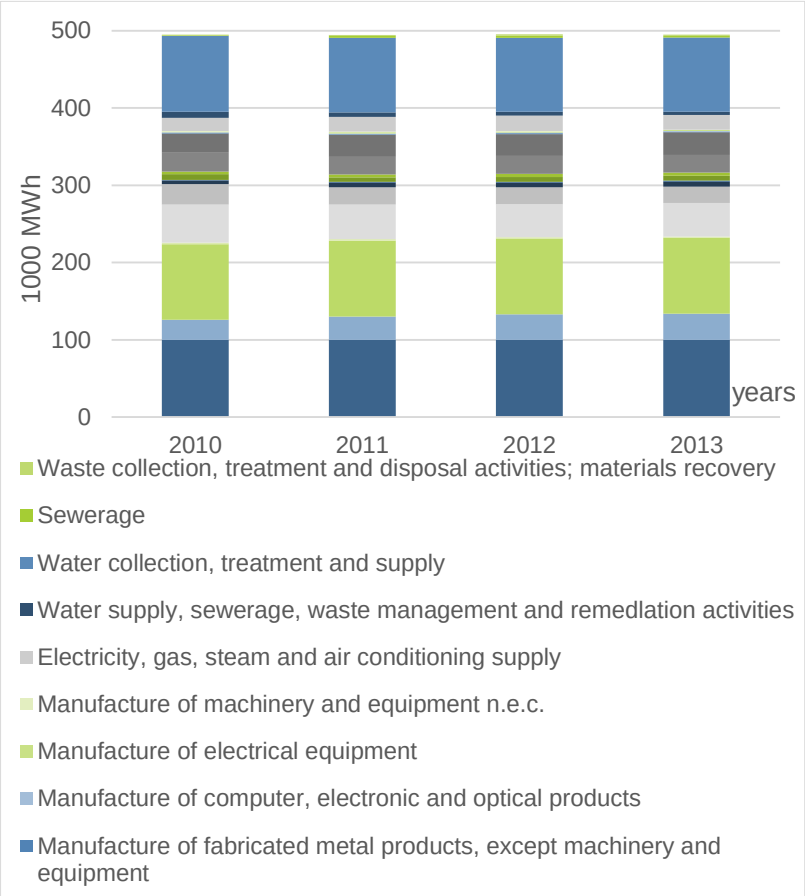


Figure 35: Electricity Consumption by Industry Sub-Sector, 2010-2012

4.4.1 Power Sector

Electricity in Armenia is generated by:

- Nuclear power plant, which generates 30-50% of the electricity needs, depending on plant uptime and ability to purchase nuclear fuel;
- hydro-electric plants, which generate about 20-40% of the country's needs; and
- thermal plants, which provide the balance of electricity needs from burning natural gas.

Municipal heat and hot water supply systems in Armenian cities essentially collapsed because of the economic and energy crisis that followed the separation of Armenia from the former Soviet Union in 1990. Though centralized district heating (DH) systems have been partially restored in some cities, most of the urban population does not have access to organized heat and hot water supply services. The population switched to gas-, electricity- or wood-fired individual heating systems with varying levels of efficiency. Well managed district heat systems are more efficient and can be a better solution for Armenia, especially if utilizing renewable energy sources. Considering Armenia's potential for geothermal energy utilization, it is important to consider

geothermal heat pumps as a district heating technology. If successful, this solution can be scaled up to larger share of consumers.

Today, in some large public and private service buildings heat is supplied by centralized boiler systems while smaller residential buildings mostly use local heating systems. However, most of the buildings equipped with central boiler systems operate inefficiently due to poor maintenance or old age. Refurbishment or reconstruction of these systems would result in a significant decrease in energy intensity and greatly reduce the maintenance burden.

The latest WB Armenia Power Sector Policy Note highlighted the urgent need for investment to mitigate the emerging energy supply gap. For example, the least efficient thermal power plant, Hrazdan TPP has an efficiency of 31%. This highly inefficient plant is currently used as the circuit station and needs to run post 2016 thus incurring heavy cost burden on the generation. This power station has been targeted for refurbishment with a new gas-fired 500 MW combined cycle gas turbine planned to be operational by 2020.

Aside from the generation, several transmission assets are in a state of disrepair and require urgent maintenance and modernization to maintain supply reliability. WB compared the Armenian transmission networks with the well-performing US and European networks, and found 2.5 higher outages per transmission line. The improved transmission reliability will significantly reduce energy losses. Several transmission project related investments are underway and planned in this direction and presented in Table 34.

4.4.2 Energy Management and Clean Production Industrial and SME

Affordability of tariffs for both natural gas and electricity has become a major concern not only for the population, but also the large industrial consumers and SMEs. Energy efficiency can help the local producers remain competitive under the conditions of growing energy prices. When energy prices increased in 2013, the National Association of Manufacturers, Entrepreneurs and Employers (NAMEE) requested Government support for seeking energy savings and energy efficiency solutions. In response, the Ministry of Energy and Natural Resources and the Ministry of Economy worked with the NAMEE to develop specific steps to reduce energy intensity in industry and improve competitiveness.

Recent pilot projects and technical assistance programs implemented by donors have identified the great potential to improve energy efficiency in industry through implementation of energy management systems, building capacity in energy auditing and application of best available technology practices for energy efficiency. It has been estimated that these initiatives could reduce energy intensity by 20% with a reasonable financial return on investment. Some of the identified measures include:

- UNIDO/REC Resource Efficiency and Clean Production Program, with RECP audits of 10 pilot enterprises revealed 15-20% cost effective energy and water use reduction possibilities;
- Ministry of Nature Protection transposing BREF notes for application of best available technologies in various sectors of the economy (including cement production and copper smelters) identified 15-18% reduction in energy use, accompanying the technological changes aimed at reducing environmental pollution.

The international best practice for a country like Armenia is to set up a Cleaner Production Assistance Center. Such a center(s) work with the of Government and academia in assisting industry through outreach programs, trainings, subsidized energy audits, dissemination of information on best available technologies, benchmarking, etc. There is a potentially great value added effect for academic institutions helping industry through outreach and research in EE and RE and thus increasing the opportunity for academic institutions to conduct more research which will provide more training for future industry participants (student and researchers). Hence, this activity must be carried out incombination with the development of adequate university curricula and preparation of adequate professorial cadre, to further prepare qualified industrial energy managers and auditors. This all contributes to improving competitiveness of the country.

4.4.3 Financing of Industrial and SME Energy Efficiency

Concurrently, several IFIs (GGF, IFC, EBRD, and soon KfW) have offered sustainable energy financing for industrial and SME borrowers during 2010-2015, with some of these loans accompanied with subsidized energy audits. Although these IFIs have not forecasted future lending plans, but it can reasonably be assumed that the same lending trend will persist and potentially accelerate in the light of growing energy costs. KfW, for example, is expected to launch a new credit line in 2016. Table 33 summarizes the data supplied by IFIs for this sector.

Table 33. EE Project Financing by IFIs in Industrial and SME Sectors

	Total Loan Portolio [USD]	Annual Lending Reported for 2010-2015						New Source
		2010	2011	2012	2013	2014	2015*	2016
EBRD								
- Industrial (specify)	3,560,000	800,000			2,760,000			
- Power Sector/generation	18,965,000			18,965,000				
- SME (specify sector)	15,290,000	1,120,000			4,720,000	9,050,000	400,000	
Subtotal	**37,815,000**	**1,920,000**	-	**18,965,000**	**7,480,000**	**9,050,000**	**400,000**	-
GGF								

- Industrial (specify)	2,440,928					2,440,928		
- SME (specify sector)	921,872					921,872		
Subtotal	**3,362,800**	-	-	-	-	**3,362,800**	-	-
IFC								
- Industrial (specify)	25,050,000					25,050,000		
Subtotal	**25,050,000**	-	-	-	-	**25,050,000**	-	-
KFW								
- SME (specify sector)	20,000,000							20,000,000
Subtotal	**20,000,000**	-	-	-	-	-	-	**20,000,000**
TOTAL	**86,227,800**	**1,920,000**	-	**18,965,000**	**7,480,000**	**37,462,800**	**400,000**	**20,000,000**

*- data for 2015 reported as of May 2015

Considering the demonstrated potential in Armenia for cost effective projects that can significantly reduce energy intensity and deliver important operational efficiency in the industrial and SME sectors, it is recommended to seek opportunities for wider implementation of resource efficiency initiatives. Implementation of ISO 5001 compliant energy management systems, conducting energy audits, and dissemination of knowledge about benchmarking practices will contribute to the increased quality of economic growth and clean production in Armenia.

The NEEAP proposes initiating a program for supporting energy resource efficiency transformation programs for large industrial companies (large energy consumers) for promotion of best practices and to accelerate the identification, planning, and implementation of high impact energy efficiency measures. Fundamentally, the program must be aimed at mainstreaming energy management and resource efficiency in large energy consuming enterprises to ensure sustainable outcomes.

The program will start with implementation of ISO 50001 Energy Management in industry. This program must be developed in cooperation with the Ministry of Energy and Natural resources, the Ministry of Economy, National Association of Entrepreneurs and Employers, Armenia's Chamber of Commerce, Regional Environmental Center (REC) and the United Nations Industrial Development Organization (UNIDO), major players in industry. The program must build a network for introducing energy management best practice, encouraging cooperation, and developing a platform for sharing lessons learned on site. The program should be introduced through voluntary compliance schemes, benchmarking, coordination with financiers for soft financing terms on targeted loans, awareness, outreach, and a clear recognition process highlighting positive outcomes.

4.4.4 EE-Integrated Renewable Energy Sources

Armenia does not have any domestic fossil fuel resources which puts the country in a perilous state of energy insecurity. National economic development is tightly linked to energy prices and availability of imported energy resources. Promotion of renewable energy technologies will also support development of technical skills in this field, create jobs, reducing national carbon footprint while helping nation's energy security. Therefore, utilization of indigenous renewable energy sources is of utmost importance. The NEEAP proposes stronger support for solar water heaters, distributed solar PV systems and piloting of geothermal heat pumps for building heat. Development of domestic renewable energy sources featured prominently in the the Primary Energy Saving Section of the NEEAP.

Similarly, the market for energy efficiency services remains one of the missing links for the private sector players to tap into energy efficiency potential in their businesses. Energy Service Companies (ESCOs) are gradually becoming a new important partner in promoting sustainable energy solutions in Armenia. Their creation has been supported by a number of donor-funded programs. As long has donor support was fully available for grant-funded energy efficiency investments, the ESCOs did not develop financing features, but built up skills for designing energy efficiency projects and implementing implemented the engineering work. As the R2E2 established the lending scheme for public building energy saving investments via energy saving agreements through ESCOs, more than 30 companies are now operating, which provide services such as weatherization, design, installation and maintenance of boiler houses, as well as broader consulting on related issues. While the ESCOs do not function under guaranteed or shared savings contracts, the payments are linked to delivered energy savings and However, they still do not share or guarantee amounts of energy saved neither do they bear direct financial risk. This is why the promotion of ESCOs, as promoters and vendors of energy efficiency, need support. This task is addressed among the cross-cutting/horizontal measures, along with the capacity building needs of other players in initiation, development and financing of energy efficiency in private sector.Overview of initiatives implemented and proposed for the industrial, power and SME sectors are presented in Table 34 with specific measures presented in the subsequent tables.

Table 34. Summary Overview of EEIMs for the industry sector (power, industry & SME)

No	Title of the energy saving measure	end-use targeted	Duration	Achieved /Expected energy savings in target year(MWh)				Status in relation to 1st NEEAP
				2014	2017	2018	2020	
IV.1.	Considering energy efficiency aspects during approval and construction of new industrial facilities	Industry & SME: ISO 50001 users, RECP, BAT, benchmarking	**Start:2016 End: ongoing**	-	271,969	397,132	718,979	not implemented
IV.2	Increasing the efficiency of the central heating plants and suppliers: Avan DH - cogeneration	Developed model of an efficient energy cogeneration and supply	Start:2010 End: ongoing	57,228	67,327	70,693	77,426	partially implemented
IV.3	Implementation of Energy Efficiency Financing Facility for Industrial Enterprises	Reported in cross-cutting section						partially implemented
IV.4.	Natural gas savings through improvement of transmission pipelines and substations, and optimisation of existing boiler houses in TPPs	TPP 500 MW to cover peaks and reserve margin, after the decommissioning of blocks 1-4 of Hrazdan TPP since 2020	Start:2020 End: ongoing	-	-	-	4,739,961	not implemented
IV.5.a	Reduction of energy losses in distribution networks: WB Electricity Supply reliability	energy generation, distribution	Start: 2015 End: 2060	-	-	-	2,560	not implemented
IV.5.b	Reduction of energy losses in distribution networks: EBRD Power Supply Reliability	reduced energy losses in distribution networks		-	-	3,311	3,311	not implemented
IV.5c.	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	Improved energy efficiency and energy savings of power sector	Start: 2012 End: 2017	-	-	18,000	18,000	not implemented
IV.5.d.	Reduction of Electricity Losses in Low-voltage networks, ArmElNet	reduced energy losses in distribution networks	Start: 2016 End: 2020	-	62,072	62,072	62,072	not implemented

No	Title of the energy saving measure	end-use targeted	Duration	Achieved /Expected energy savings in target year(MWh)				Status in relation to 1st NEEAP
				2014	2017	2018	2020	
IV.6	Wider Application of Renewable Energy: SWHs	The measure is designed on the basis of realized best practices and experiences.	Start: 2016 End: 2020 (and beyond)	5	10	12	16	new measure
IV.5.b	Geothermal Heat Pumps for Central Heating	space heating, energy efficiency, renewables, PPP	Start: 2016 End: 2020 (and beyond)	-	705	705	705	new measure
	Total Industry & Power (MWh)			**57,233**	**402,082**	**551,925**	**5,623,030**	
	Total Industry & Power (toe)			**4,921**	**34,573**	**47,457**	**483,494**	

Individual measures are presented below.

Table 35: Specific measures associated with the initiatives presented in Table 34 above

Title of the energy saving measure		**Energy Management**
Index of the measure		**IV.1.**
Description	**Category**	Information and mandatory information measures, Voluntary measure
	Timeframe	Start: 2013.
		End: 2015. (2020.)
		The measure is linked to the agreement between RA Government and The union of manufacturers and businessmen (employers) of Armenia for energy management, resource efficiency and environmental performance in industry sector.
	Aim/brief description	The main objective of measure is to provide fast and quality cooperation between industry and exchange of good practice during the implementation of organizational recommendations contained in ISO 50001.
		This measure provide support for assessment of potential energy savings in industrial plants through an implementation of energy audit. The audit scheme for the industry should include: - mandatory energy audits for companies with an annual energy consumption of more than than prescribed with the law; - voluntary scheme for other companies, especially for SMEs. - Introduction and implementation of ISO 50001 scheme for Energy Management in Industry.
	Target end-use	Increased resource and energy efficiency in manufacturing industry
	Target group	Industry sector
	Regional application	National

Title of the energy saving measure		**Energy Management**
Information on implementation	**List and description of energy saving actions substantiating the measure**	Promotion of ISO 50001. The purpose of this International Standard is to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency and intensity. The standard should lead to reductions in cost, greenhouse gas emissions and other environmental impacts, through systematic management of energy. Application of the standard can be tailored to fit the requirements of the organization, including complexity of the system, degree of documentation, and resources and applies to the activities under the control of an organization. - To organize training on implementation of Energy Management in Industry. - To organize trainings for obtaining authorization for energy auditors and licenses for energy audit performing. - To prepare manuals for training programmes for experts entitled to perform energy auditing . - To realize energy audit of industrial processes. - Good housekeeping includes no-cost or low-cost measures and activities such as tracking steam and compressed air leaks, tuning boiler and furnace burners, piping insulation, replacing leaking steam traps, shutting-off equipment when it is not required, as well as preventing maintenance on heat transfer equipment (i.e., heat exchangers), and on pumps, fans, compressors, measuring devices, and control systems. Most of the savings are related to steam generation, distribution and condensate return. -Promotion of good practices in the use of energy in appliances and equipment, use of raw materials, production, waste materials handling, maintenance, etc. -Dissemination of the results and achievements. -One of the most important issue for direct practicing of good house-keeping is motivation of employees directly dealing with the facilities and equipment and that should be a task of the management of the companies.
	Budget and financial source	$3,000,000
		Government, PS, other.

Title of the energy saving measure		**Energy Management**
	Implementing body	Academic institutions - Preparation of training programmes for experts entitled to perform energy auditing and inspection. Consulting organizations – performing energy audits Academic institutions, Private sector, NGO- Provide consultancy services, trainings of auditors etc. Financial institutions- Soft loans for EE projects State Statistical Office of RM- Collection, processing and dissemination of statistical data.
	Monitoring authority	MoENR, Ministry of Economy
Energy savings*	**Method for monitoring/measuring the resulting savings**	Industrial energy auditing
	Expected savings in 2014 as per 1st EEAP	New
	Savings achieved in 2014* , MWh	67,992.19
	Savings achieved in 2017 , MWh	271,968.78
	Expected energy savings in 2018* , MWh	397,131.57
	Expected impact on energy savings in 2020 (if available)	718,978.76
	Assumptions*	Funding availability
	Overlaps, multiplication effect, synergy	synergy with amendments of ES&RE Law on mandatory energy audits, REC/RECP initiatives, BREF/BAT introduction, etc

Title of the energy saving measure		Increasing the efficiency of the central heating plants and s uppliers: Avan DH - cogeneration
Index of the measure		IV.2
Description	Category	Cross-cutting
	Timeframe	Start: 2005, ongoing
	Aim/brief description	UNDP CHP Project in Avan district connected 36 multi-apartment buildings to Avan CHP.
	Target end-use	Developed model of an efficient energy cogeneration and supply
	Target group	Citizens
	Regional application	Regional (Yerevan/Avan)
Information on implementation	List and description of energy saving actions substantiating the measure	Project assistance included: i) development of the feasibility study; ii) development of a regulatory framework to reduce commercial risk, by establishing public-private partnerships and establishing preferential tariffs for electricity generated from cogeneration units and two-part tariffs for supplied heat; iii) assistance in negotiations between private sector and national authorities – Government, Regulator and Yerevan Municipality - during the initiation and implementation of the pilot project; iv) organisation of consultations with the Avan district community and condominium management; v) surveys of public opinion in the pilot area; vi) provision of international consultants, particularly Ramboll A/D and organisation of study tours for national decision-makers; vii) provision of apartment level heat and hot water metering equipment; viii) Monitoring system operation. The Autonomous Thermal Power Plant with - 4MWe and 4.36 MWt capacity was commissioned on 15 December 2009. As of 2012, one CHP unit and one peak boiler had been installed to supply 30 apartment buildings, one schoo ments- USD 12 mln. USD The system was commissioned on 15 December l and two kindergartens (5,000 residents). Leveraged foreign direct invest 2009
	Budget and financial source	$ 12,000,000
	Implementing body	UNDP
	Monitoring authority	UNPD
En er gy sa	Method for monitoring/mea	Measuring the periodic consumption of energy by selected district and comparing to the previous data

Title of the energy saving measure		Increasing the efficiency of the central heating plants and s uppliers: Avan DH - cogeneration
	suring the resulting savings	The GHG emissions reduction assessment for the Avan district heating restoration project compared the project emissions with the baseline scenario of 75% of households using natural gas-fired and 25% using electric appliances for both their heat and hot water needs. The annual GHG emissions reduction of the first phase of the project amounted to 10,200 t CO2eq.
	Savings achieved in 2014 as per 1st EEAP	57,228
	Savings achieved in 2014 (mWh)	67,327
	Expected energy savings in 2018* mWh	70,693
	Expected impact on energy savings in 2020 (if available) ktoe	77,426
	Assumptions*	
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		Natural gas savings through replacing old turbines with new and more efficient turbines in TPPs
Index of the measure		**IV.4.**
Description	**Category**	Utility, power generation, supply-side
	Timeframe	Start: 2018 End: 2020
	Aim/brief description	In 2019 it is scheduled to take out of operation 1-4 blocks in Hrazdan TPP, instead of with it is planned to put into operation 500MW TPP in 2020

Title of the energy saving measure		Natural gas savings through replacing old turbines with new and more efficient turbines in TPPs
	Target end-use	Improved energy efficiency and energy savings of power sector
	Target group	Power sector
	Regional application	National
Information on implementation	List and description of energy saving actions substantiating the measure	TPP 500 MW proposed by the WB to cover peaks and reserve margin, after the decommissioning of blocks 1-4 of Hrazdan TPP
	Budget and financial source	$ 515,000,000.00
	Implementing body	World Bank, MoENR
	Monitoring authority	World Bank, MoENR
Energy savings	Method for monitoring/measuring the resulting savings	National BU
	Expected savings in 2012 as per 1st EEAP, MWh	
	Savings achieved in 2012*,, MWh	
	Expected energy savings in 2018, MWh	
	Expected impact on energy savings in 2020, MWh	4,739,961
	Assumptions*	The new gas turbine will be replacing the oudated facility Hrazdan TPP, phasing out excessive gas consumption due to low efficiency of the old unity (31%), while the new will have 49% eff.
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		Reduction of energy losses in distribution networks: WB Electricity Supply reliability
Index of the measure		IV.5.a
Category		Programs, Financing

Title of the energy saving measure		Reduction of energy losses in distribution networks: WB Electricity Supply reliability
	Timeframe	Start: 2015 End: 2060
	Aim/brief description	WB Electricity Supply Reliability Project reducing system losses from 2.2-2.7 % to 0.7% reaching positive net economic benefit in 2030.
		Cost: $102 million (WB + RoA Govt).
	Target end-use	energy generation, distribution
	Target group	Power industry
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	The proposed project represents phase 1 of the comprehensive program to rehabilitate 220 kV transmission network and substations in Armenia that will upgrade the national power system operation reliability and efficiency, and enhance transmission capacity. Phase 1 of the project will include three main components: (i) expansion of supervisory control and data acquisition (SCADA) system and energy management system (EMS), (ii) rehabilitation of four existing 220/110-kilovolt (kV) substation, and (iii) support for institutional development, capacity building, and project management. The benefits of avoided equipment breakdown can be quantified in terms of avoided loss of energy, measured in kWh. All four concerned substations are over forty years old and physically and morally obsolete what causes frequent failures of individual components and temporary shutdowns. The substations are expected to become fully non-operational shortly and if they are not replaced the total loss of generation is quantified in final feasibility study at 5,474 GWh, what corresponds to more than 80% of total supply in Armenia. The rehabilitation of 4 substations will improve operational efficiency of whole internal transmission network, by reducing the number of unplanned outages (defined as outages above 1 hour) in the 220 kV transmission network by 50%.
		Replacement of one section of the power transmission backbone, the transmission line connecting two key generation centers in the central part of the country (Hrazdan Thermal Power Plant) and in the South (Vorotan Cascade of hydropower plants), and service for large electricity consumers in the central-eastern part of the country. Replacement of the targeted section of the transmission line is critical, since it is in extreme disrepair and jeopardizes the

Title of the energy saving measure		Reduction of energy losses in distribution networks: WB Electricity Supply reliability
		reliability of the power supply and overall network stability. The line was constructed in 1956–58 and has been in service since then. Conductors, pylons, insulators, and other key pieces of infrastructure are obsolete and need replacement. There are also a number of critical substations that are essential to the reliability of the power supply in the country and require urgent rehabilitation, particularly given that some of the equipment dates back to the 1930s and has not been replaced since then.
		The Additional Financing will be rehabilitating three of those substations: Haghtanak, Charentsavan-3, and Vanadzor-1.
	Budget and financial source	US$ 41,550,000 for now
		WB, GoA
	Implementing body	MoE, WB
	Monitoring authority	MoE, WB
Energy savings	**Method for monitoring/measuring the resulting savings**	
	Expected savings in 2017 as per 1st EEAP	
	Expected achieved in 2018	66.3
	Expected energy savings in 2020	91.5
	Expected impact on energy savings in 2020 (if available)	146.6
	Assumptions*	

Title of the energy saving measure		Reduction of energy losses in distribution networks: WB Electricity Supply reliability
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		Reduction of energy losses in distribution networks: EBRD Power Supply Reliability
Index of the measure		IV.5.b
Description	Category	Rehabilitation, capacity building
	Timeframe	Start: 2016 End: ongoing
	Aim/brief description	EBRD -Armenia Power Supply Rehabilitation Project: Phase 1. Rehabilitation of 220 kV transmission network and substations in Armenia
	Target end-use	reduced energy losses in distribution networks
	Target group	Power industry
	Regional application	National
Information on implementation	List and description of energy saving actions substantiating the measure	Rehabilitate key substation and transmission lines critical for system-wide reliability of power supply
	Budget and financial source	US$ 70,000,000
	Implementing body	MoE
	Monitoring authority	
Energy savings	Method for monitoring/measuring the resulting savings	
	Expected savings in 2012 as per 1st EEAP	
	Expected energy savings in 2017*	
	Expected energy savings in 2018*	3,311
	Expected impact on energy savings in 2020 (if available)	3,311
	Assumptions*	
	Overlaps, multiplication effect, synergy	submitted for consideration for E5P grant co-financing

Title of the energy saving measure		Reduction of Electricity Losses in Low-voltage networks, ArmElNet
Index of the measure		**IV.5.d.**
Description	**Category**	Rehabilitation, capacity building, financing
	Timeframe	Start: 2016 End: 2020
	Aim/brief description	Reduce the network energy losses by an average of
	Target end-use	reduced energy losses in distribution networks
	Target group	Power industry
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	(1) reorganization of transformers based on current substation loads (2) deeper penetration (bringing high voltage transmission lines closer towards retail (low voltage) consumers)); (3) ensuring symmetrical loads equalizing phases in transmission lines (supplementing missing loads) (4) changing the of the wire sections to cost-optimal size to meet current loads; (5) modernization of switchboard equipment
	Budget and financial source	$ 22,768,434
	Implementing body	ArmElNet
	Monitoring authority	MoENR
Energy savings	**Method for monitoring/measuring the resulting savings**	
	Expected savings in 2014 as per 1st EEAP	0
	Expected energy savings in 2017*	62,072
	Expected energy savings in 2018*	124,144
	Expected impact on energy savings in 2020 (if available)	496,577
	Assumptions*	financing availability
	Overlaps, multiplication effect, synergy	submitted for consideration for E5P grant cofinancing

Title of the energy saving measure		**Wider Application of Renewable Energy: SWHs**
Index of the measure		**IV.6**
Description		Financial instruments, Regulation, Information
	Timeframe	Start: 2016 End: 2020 (and beyond)
		The measure is designed on the basis of realized best practices and experiences.
	Aim/brief description	Considering the positive trend in installation of solar water heaters (SWHs), and recognizing the potential for these systems to help contribute to nationwide energy saving, this measure aims at encouraging the wider application of solar thermal systems for hot water preparation and the use of heat pumps in heating systems and wider application of solar thermal systems for hot water preparation.
		Installation of solar thermal systems for hot water preparation is mandatory for public buildings during their rehabilitation, if there is economical justification.
		Suggest legal requirement for new buildings and building units subject to major renovation owned by the state or the municipalities to incorporate solar thermal systems for the preparation of hot water where it is economically justified. Solar collectors should be installed in hospitals, kindergartens, secondary school and university students' residence halls, social care facilities, sports halls, justice and military institutions... Economic viability and relatively acceptable payback period of the investment can be provided with large hot water needs during the day and during the year. As an alternative, but also complement to the solar systems are geothermal heat pumps, which provide efficient heating and cooling of buildings with an efficiency of over 400% lodged in terms of energy (1 kWh electrical energy provides up to 4 kWh heat).
	Target end-use	The use of renewable energy (solar thermal systems, heat pumps, biomass)
	Target group	Municipal, residential
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	1. Law on Yerevan City Center
		2. Law on Dilijan – Green City
		3. Amendment 1405 (Dec 25, 2014) to Law on ES&RE on Mandatory EE in public procurement

Title of the energy saving measure		**Wider Application of Renewable Energy: SWHs**
		4. Mandatory application of solar systems for hot water preparation for new public buildings and building units and public buildings and building unit subject to major renovation, if economically justified;
		2. Energy auditors control -proper realization of BEP; 3. Government Financial incentives;
		4. NGO, Private sector awareness, information, promotion;
		5. Academic institutions, Private sector Development of domestic technologies, Transfer of know-how
	Budget and financial source	TBD
	Implementing body	MoENR, R2E2, KfW, AFD/NMC, GGF
	Monitoring authority	R2E2
Energy Savings	**Method for monitoring/measuring the resulting savings**	Monitoring the effects of these measures is realized using the NBU method where are set up a national benchmarks. Details are given in the document "Measurement and verification of energy savings using the method of bottom-up".
		To monitor the effects of these measures will be used NBU method for solar systems as recommended by the EC. Beneficiaries of funds required by local and territorial (regional) governments provide information about the surface and the type of installed collector (plate or tube), as well as the efficiency of the hot water that was used prior to the installation of solar panels.
Energy savings*	**Expected savings in 2014 as per 1st EEAP MWH**	1
	Savings achieved in 2014* MWH	4.8
	Expected energy savings in 2017 MWH	9.6
	Expected energy savings in 2018*	11.8

Title of the energy saving measure		**Wider Application of Renewable Energy: SWHs**
	Expected impact on energy savings in 2020 (if available) MWH	16.4
	Assumptions	Although 1st Energy Efficiency Action Plan gives approximate estimates for achieving energy savings that are associated with this measure, due to the lack of detailed plans for the implementation and the uncertainty related to the response of MoENR and R2E2, for the next period is not possible to give precise estimates of potential savings. However, it is assumed that all consumers will establish cooperation with the EEF to co-finance the installation of solar thermal systems.
	Overlaps, multiplication effect, synergy	

Title of the energy saving measure		**Geothermal Heat Pumps for Central Heating**
Index of the measure		**IV.5.b**
Description	**Category**	Financial instruments, Regulation, Information
	Timeframe	Start: 2016 End: 2020 (and beyond)
	Aim/brief description	
	Target end-use	space heating, energy efficiency, renewables, PPP
	Target group	Municipal, private sector, PPP
	Regional application	Pilot in Jermuk, Vayots Dzor Region, scale out to nationwide
Information on implementation	**List and description of energy saving actions substantiating the measure**	As a supplement to EE and SWH, geothermal heat pumps can provide efficient heating and cooling of buildings with an efficiency of over 400% lodged in terms of energy (1 kWh electrical energy provides up to 4 kWh heat). Design and implement a pilot project for a typial building 5-floor building is necessary to verify the cost-effectiveness and economic viability of this technology for heating residential and public buildings. It is key to seek a public-private partnership arrangements whereby a private energy service provider can partner with the local Government (Jermuk municipality, in this

Title of the energy saving measure		Geothermal Heat Pumps for Central Heating
		case) for utilization of municipal assets and private management, investment co-financing and know-how.
	Budget and financial source	$ 68,250.60
		E5P, own resources, other
	Implementing body	MoENR, Municipality of Jermuk, Vayotz Dzor Regional Administration
	Monitoring authority	MoENR
Energy savings	**Method for monitoring/measuring the resulting savings**	Bottom-up
	Expected savings in 2017 as per 1st EEAP (MWh)	705
	Expected achieved in 2018 (MWh)	1,410
	Expected energy savings in 2020 (MWh)	2,820
	Assumptions*	financing will be secured and technical solution successful
	Overlaps, multiplication effect, synergy	Application submitted to E5P for grant co-financing

Title of the energy saving measure		Electricity savings through improvements of existing electric ity network, compensation of reactive power and improveme nt of transformers
Index of the measure		**IV.5c.**
Description	**Category**	Capacity building
	Timeframe	Start: 2012 End: 2017
	Aim/brief description	Under the project financed through the Asian Development Bank loan (2013) it is planned to rehabilitate and upgrade four of seven HPPs in Sevan-Hrazdan Cascade Hydropower System, rehabilitation of water outflow canals in three plants and replacement of electrical equipment in the plants respectively.

Title of the energy saving measure		Electricity savings through improvements of existing electric ity network, compensation of reactive power and improveme nt of transformers
	Target end-use	Improved energy efficiency and energy savings of power sector
	Target group	Power sector
	Regional application	National
Information on implementation	**List and description of energy saving actions substantiating the measure**	The project includes two major components: extension of dispatching control and data collection system (SCADA), and rehabilitation of eight existing 220 kV substations with respective replacement of aged transformers, circuit breakers and other equipment. The project aims to restore the capacity of the hydropower plants by 44.7 megawatts (MW), improve their reliability and safety, and reduce IEC's operational and maintenance expenses. The project will also reduce water leakage from the diversion channels and could increase power generated by the system. After repair of the diversion channels, it is estimated that water leakage will decrease by 50 million–85 million cubic meters annually, which will bring additional generation of 18–30 GWh of electricity.
	Budget and financial source	$ 25,000,000.00
	Implementing body	MoE
	Monitoring authority	
Energy savings	**Method for monitoring/meas uring the resulting savings**	NBU
	Expected savings in 2012 as per 1st EEAP	
	Savings achieved in 2012*	
	Expected energy savings in 2018* , mWh	18,000.00

Title of the energy saving measure		Electricity savings through improvements of existing electric ity network, compensation of reactive power and improveme nt of transformers
	Expected impact on energy savings in 2020 (if available), mWh	54,000.00
	Assumptions*	
	Overlaps, multiplication effect, synergy	

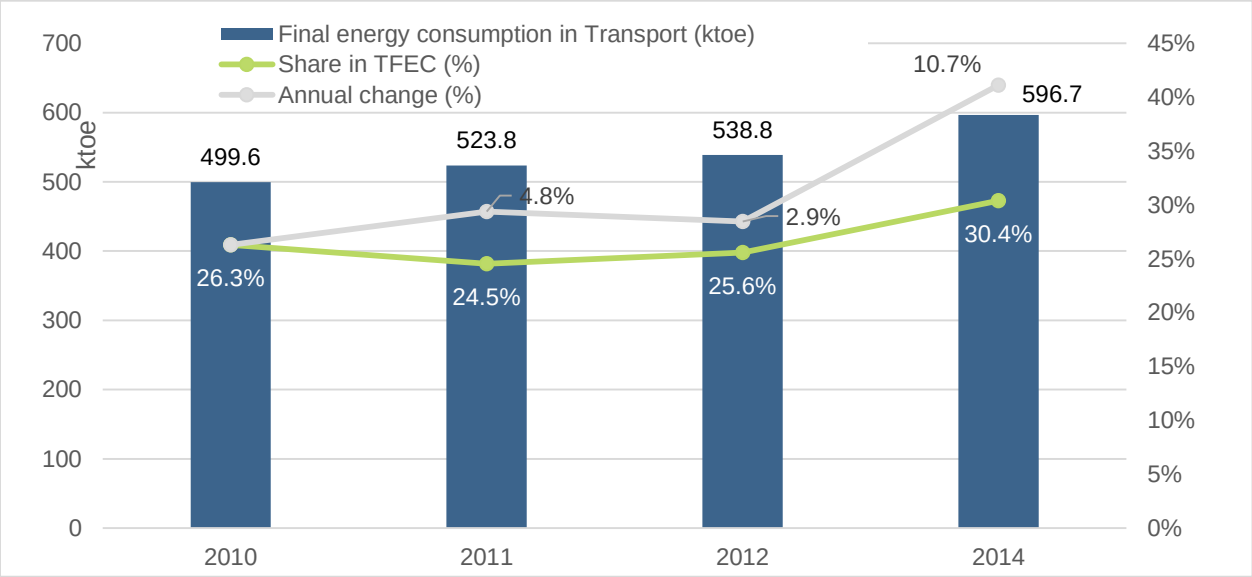
Title of the energy saving measure		Development of distributed solar PV generation through implementation of Net metering provision
Index of the measure		IV.2
Description	Category	Policy implementation, Regulation, Information
	Timeframe	Start: 2016 End: ongoing
	Aim/brief description	Net Metering provides PV customers with opportunity to have a zero charge against their electricity consumption if it is offset by the PV generation
	Target end-use	Distributed generation, solar energy, autonomous electricity production, net metering
	Target group	Citizens, autonomous electricity production for own needs
	Regional application	National
Information on implementation	List and description of energy saving actions substantiating the measure	The 2003 Law on Energy Saving and Renewable Energy created the legal provision for net metering. In 2005 the PSRC developed the procedures for parallel operation of autonomous renewable energy producers, which defined the non-commercial relationship of the electric network with the micro-generation facilities with capacity under 150 kW (PSRC Resolution №194, 30.11.2005). The regulation, however, has failed to be implemented due to tax accounting issues, which require immediate solution. With the growing energy tariffs, the small-scale solare PVs systems hold a large potential to help develop the distributed RE generation.

Title of the energy saving measure		Development of distributed solar PV generation through implementation of Net metering provision
	Budget and financial source	$ 66,000,000
	Implementing body	GoA
	Monitoring authority	
Energy savings	Method for monitoring/measuring the resulting savings	
	Savings achieved in 2012 mWh	133
	Savings achieved in 2014 mWh	501
	Expected energy savings in 2017* mWh	1,938
	Expected energy savings in 2018* mWh	2,729
	Expected impact on energy savings in 2020 (if available) mWh	5,094
	Assumptions*	Assuming that the GoA will take the necessary measures to implement the provision: Assuming the current trend of installing Solar PV increases by 30% from the reference value of 2014-2015
	Overlaps, multiplication effect, synergy	

4.5 Transport/Mobility

According to recent studies supported by USAID to investigate the Energy-Fuel Balance of Armenia, the transport sector in Armenia's economy was the second biggest energy consumer for three consecutive years (2010-2012), surpassed only by the residential sector. In 2010, the transport sector consumed about 500 ktoe (which was 26.3%of the nation's total consumption). **Figure *36*** shows the energy consumption trend of the transport sector.

Figure 36. Final Energy Consumption in Transport Sector, 2000-2015 (ktoe, % of total, % annual change)



Source: USAID Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) for 2010-2012, for 2014 – authors' own calculations based on PSRC and NSS data.

The main primary energy sources consumed by the transport sector include:

- motor fuels (mainly gasoline, diesel and compressed natural gas or CNG) consumed by all types of road transport (RT);
- electricity consumed by public transport (mainly by the metro systemin the capital Yerevan and trolleybuses) and railroad (more than 95% of Armenia's railroad networkis electrified);
- jet kerosene consumed by air transport.

According to Armenia's the Third National Communication on Climate Change and GHG Inventory, there were about 434,600 units of registered road transport (RT) vehicles in Armenia, of which 70% (about 300,000) in running condition. Table 36summarizes the

available data on the structure of the RT fleet actually running in Armenia in 2010 by the main category and motor fuel burned.

Table 36. RT Fleet (Number) Actually Running in 2010, by Main Category and Motor Fuel Burned.

RT Fleet Category	Gasoline	Diesel	CNG	*Total RT by Category*
Passenger Cars	165,171	1,409	80,999	***247,579***
Buses and Minibuses	3,962	1,902	5,521	***11,385***
Trucks	13,434	12,550	14,848	***40,832***
Total RT by motor fuel	182,567	15,861	101,368	*299,796*

Source: GHG Inventory, Transport Sector. Yerevan, October, 2013.

One third of the running RT fleet in 2010 used CNG. The passenger car category accounted for about 83% of the total running RT fleet; in this category, the share of cars on CNG was about 34%, or about 81,000 cars (see Table 36)[32]. The share of buses using CNG (mainly Russian-made Gazel type of minibuses) was even higher, at almost 50%. During past 10-12 years, the CNG consumption by RT increased by about 11 times from

[32]According to data from Armenian RT Technical Inspection, 51% of the passenger cars actually running in 2010 was Pre-Euro standard cars (aged before 1992). Euro 1 and 2 technological standard carsaccounted for about 14% respectively, and Euro 3 and 4technological standard carsaccounted for about 10.5% respectively.

21 kt in 2000 up to 229 kt in 2010, making Armenia the world leader by the share of transport running on this relatively low-carbon fuel.[33]

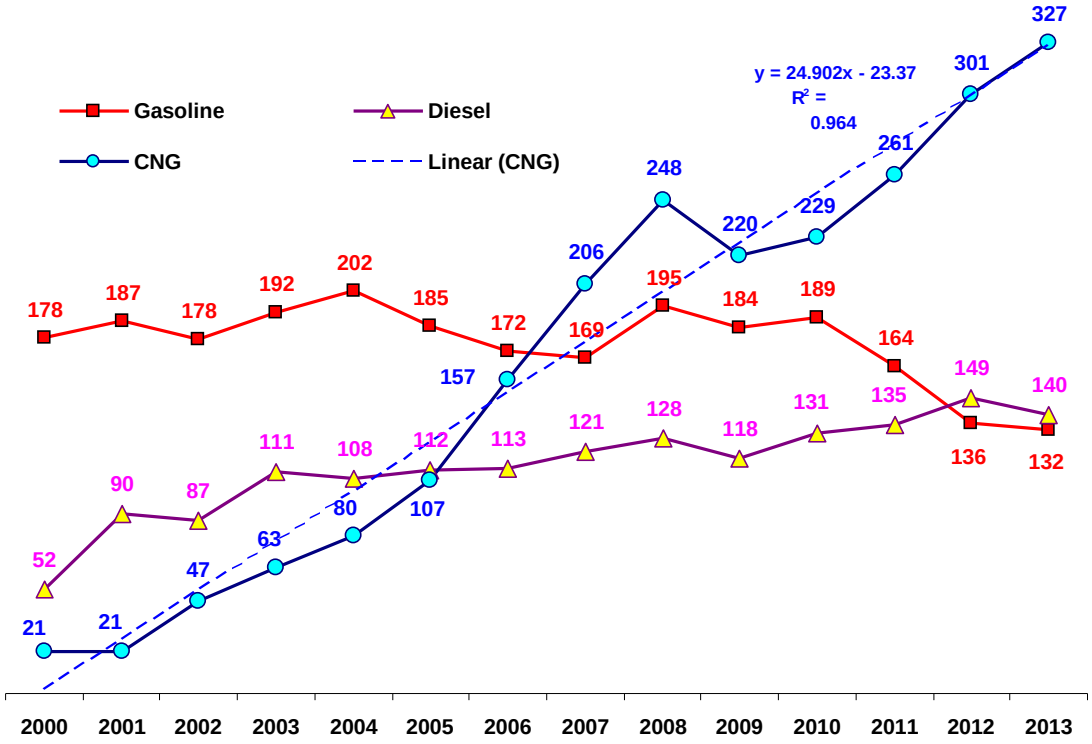


Figure 37. Annual Growth of Motor Fuel Consumption by RT, 2000-2013, (in 1,000 tons).

Source: GHG Inventory, Transport Sector. Yerevan, October, 2013.

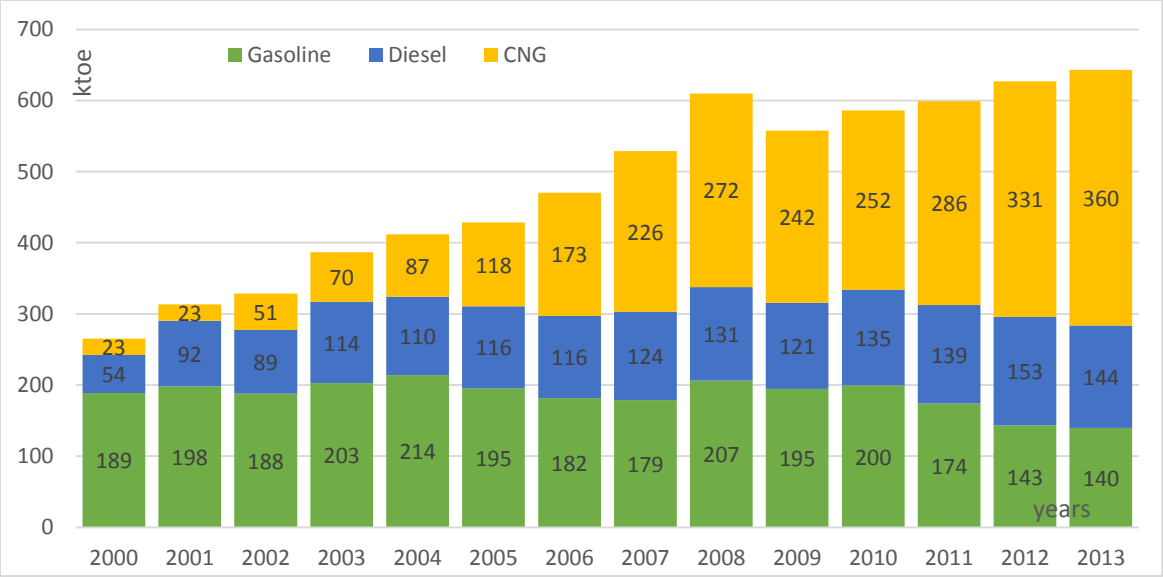
The rapid growth of CNG used by road transport in Armenia during the past 14 years is highlighted inFigure 37. During 2000-2013, the CNG consumption increased by about 16 times, from 21 kt in 2000 up to 327 kt in 2013. With an accuracy level of 96.4%, CNG consumption growth for the period of 2000-2013 can be approximate with the linear trend. The accuracy of linear approximation would have been even greater if we had smoothed out the variation caused by the realities of the 2008 crisis. By 2009, consumption of CNG was visibly declining, but returned to the same linear growth in the subsequent years (Figure 37).

In 2006, the amounts of gasoline and CNG consumed by RT became equal. Since then, CNG has surpassed the share of gasoline consumption. It should be noted that during last 3-4 years, the growth rate of CNG consumption by RT has become even faster, which has been exactly mirrored by the decline of gasoline consumption. In 2012, the share of CNG for the first time

[33] According to the Bloomberg Agency: "Armenia is not generally known as a world leader, but it holds at least one record: Seventy-five percent of its cars and trucks run on natural gas", 26 June 2012. bloomberg.com.

accounted for more than 50% of the overall annual fuel consumption by RT, making Armenia the world leader in this aspect.

Figure 38. Motor Fuel Consumed by Armenian RT, 2000-2013



Source: GHG Inventory, Transport Sector. Yerevan, October, 2013.

Figure 38. Motor Fuel Consumed by Armenian RT, 2000-2013 above highlights the data on motor fuel annual consumption by Armenian RT in ktoe for 2000-2013, based on data obtained from the Ministry of Economy and the Armenian Custom Service. It should be noted that the data in **Error! Reference source**

ot found.this figure differs from the EC-LEDS Energy Balance data for 2010-12 due to the differences in calculation methodologies.

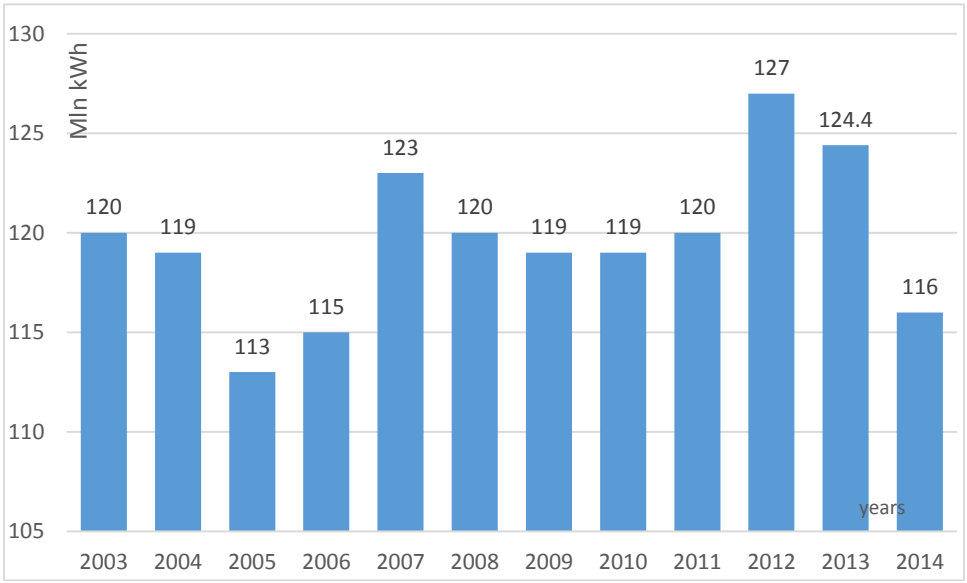


Figure 39. Annual Electricity Consumption (Million kWh) by Armenian Transport Sector, 2003-2014.

Source: PSRC RoA.

Figure 39 highlights the annual electricity consumption by transport forthe 2003-2014 period. It is noteworthy that despite such increases in energy consumption in the sector, the overall delivery of transport services has declined.

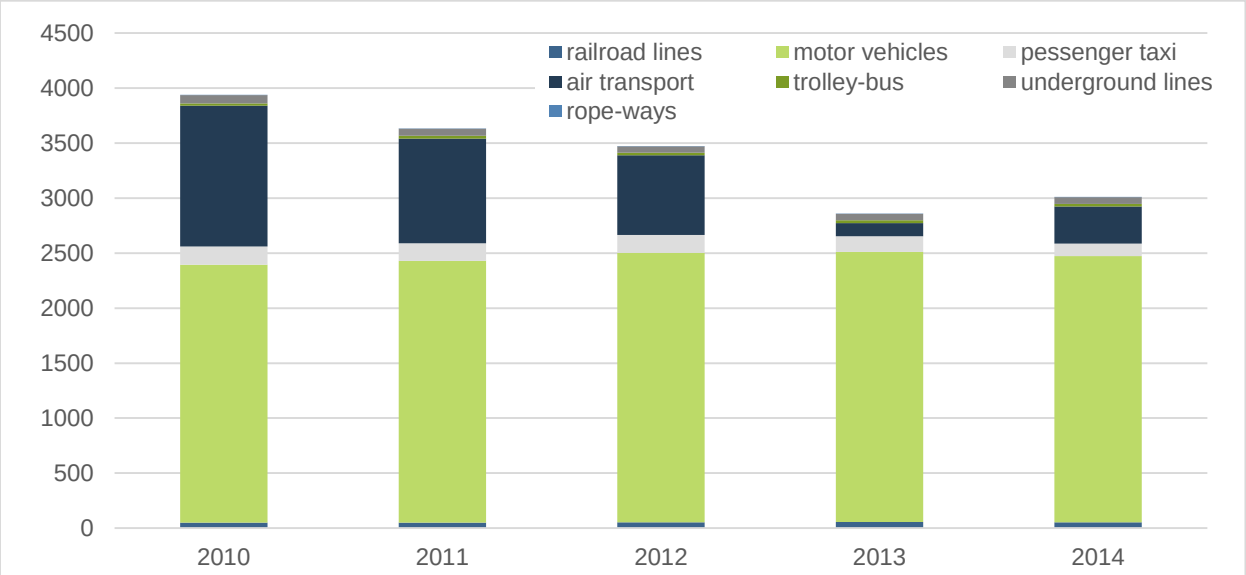


Figure 40. Passenger Turnover (Million Passenger Kilometers Travelled)

As highlighted in Figure 40 regarding the passenger and goods turnover, the energy intensity of the transportation services has grown due to the lack of efficiency in the fleet and infrastructure.

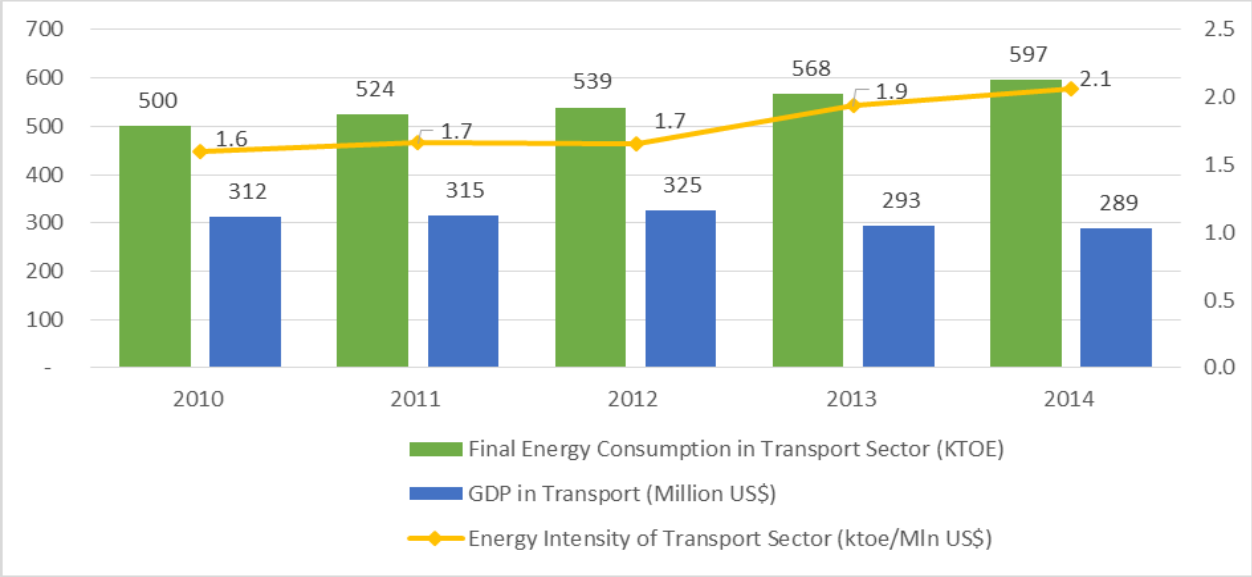


Figure 41. Energy Intensity of Transport Sector

Under such circumstances, especially in the light of growing energy prices, energy efficiency measures are necessary to maintain affordable transportation services, which will in turn support all the other economic sectors.

The first NEEAP defined several measures, as listed below, aimed at reducing energy consumption growth in the transport sector, with a special focus on road and rail transport.

V1. Development of legislative background on fuel efficiency and emission norms

V2. Dissemination of information on technologies and energy savingV3. Continuous replacement minibuses by larger passenger buses and route optimization

V4. Expansion and modernization of the electrified public transport

V5. Expansion and modernization of rail transport network (passenger and freight)

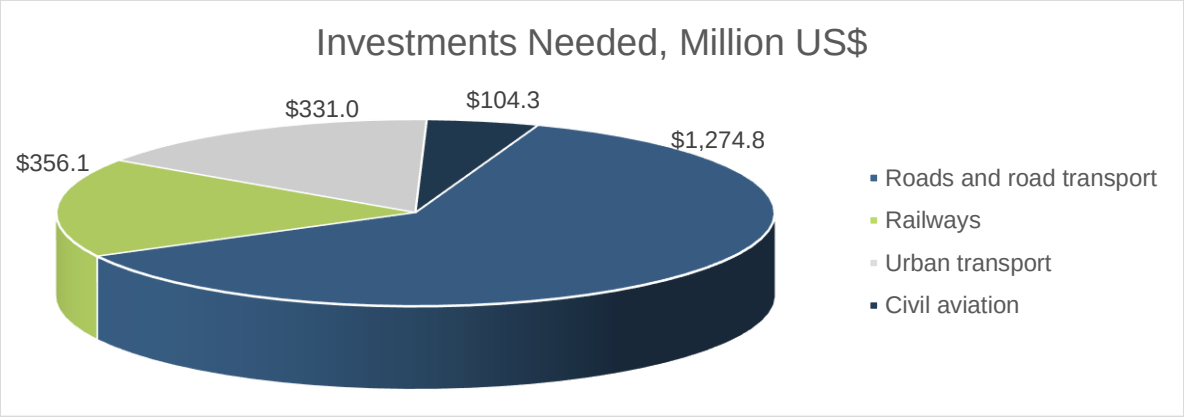
In addition, two new measures, as listed below, were integrated in the second NEEAP, including:

V6. Continuous switching of road vehicles from gasoline to CNG

V7. Development of an integrated electro-transport network and services to cover unsatisfied demand in public transportation services in the greater Yerevan area

The “Armenian Transport Sector Development Strategy 2020” (2008) and the associated documentswere updated as the Transport Sector Master Plan was integrated into the Armenia Sustainable Development Program 2014-2025, and a dedicated investment plan was developed. This plan includes 58 investment projects, with the total cost estimated at about US$2 billion, of which about $1.3 billion is for 49 new projects and $0.7 billion for 10 ongoing projects. The 14 TA projects, at an estimated cost of $36.8 million, include feasibility studies for potential projects, advisory support for planning, technical knowledge transfer and institutional capacity development.

Figure 42. Investments Needed to Implement the Republic of Armenia’s Sustainable Transport Strategy



Substantial financial resources have already been set aside by the government, the IFIs and donors to implement the infrastructure development projects in the transport sector (see Table 37).
The funding needs of the development projectsshould target the road transport network, railway, urban public transport and civil aviation. The breakdown of the estimated investments required is presented in the following chart.

Table 37. Major Development Partners in Armenia'sTransport Sector

Development Partner	Project Name	Duration	Amount (US$million)
ADB	**North–South Road Corridor Investment Program. Tranches 1, 2, 3**	**2012 2017**	$ 330.0
	Sustainable Urban Development Investment Program. Tranche 1	**2011-2016**	$48.6
EIB	**Planned North–South Road Corridor Project: Lanjik – Gyumri Road**	**2013-2015**	€60.0
EDB	**Planned North–South Road Corridor Project, Ararat – Megry Road**	**2014-2016**	$100.0
EIB, EBRD, NIF	**Yerevan Metro Rehabilitation II**	**2012**	€15.0
EBRD	**Bridge construction near Georgian border**	**2013-2016**	€10.3
World Bank	**Lifeline Road Network Improvement Project, with additional financing**	**2009-2013**	$126.0
	Lifeline Road Network Improvement Project	2013-2017	$56.3

The measures indicated in the first NEEAP were implemented to a certain extent. The greatest savings were achieved by the V3. measure "Continuous replacement of minibuses by larger passenger buses and route optimization of public transport". The table below summarizes the energy efficiency improvement measures in the transport sector.

Table 38. Overview of Individual Measures in the Transport Sector

Index	Title of the Energy-saving Measure	End-use Targeted	Achieved Energy Savings in 2014 (MWh)	Energy Savings Expected in 2017 (MWh)	Energy Savings Expected in 2018 (MWh)	Energy Savings Expected in 2020 (MWh)	Status in Relation to 1st NEEAP	Additional Comments
V1	Development of legislative background on fuel efficiency and emission norms	Regulatory, feasibility studies	N/A	N/A	N/A	N/A	Partially implemented	
V2	Dissemination of information on technologies and ES	Information					Not yet implemented	
V3	Continuous exchange of mini buses by larger passenger buses	Road transport	821,022	1,045,391	1,118,245	1,267,202	Partially implemented	
V4	Expansion and modernization of the electrified public transport	V4.1.Yerevan metro		5,294	5,294	5,294	partially implemented	
		V4.2. Electric transport – trolleys	N/A	N/A	N/A	N/A	Not yet implemented	Pre-feasibility stage,
V5	Expansion and modernization of rail transport network (passenger and freight)	Railroad transport	582	862	972	1,206	Partially implemented	
V6	Continuous switching of road vehicles from gasoline to CNG	Road transport					Partially implemented	
V7	Development of an integrated electro-transport network and services to cover unsatisfied demand in public transportation services in the greater Yerevan area	Information, planning	N/A	N/A	N/A	N/A		
	Total	**MWh**	821,604	1,051,547	1,124,511	1,273,702		
	Total	**ktoe**	70.6	90.4	96.7	109.5		

Overview of the Individual EEIM Measures for Transport/Mobility is presented in the below tables.

Title of Energy Saving Measure		**Development of legislative background regarding fuel efficiency and emission norms of vehicles**
Index of the Measure		**V.1**
Description	**Category**	V. Transport sector
	Timeframe	Start: 2014
		End: 2025
	Aim/Brief Description	"Armenian Transport Sector Development Strategy 2020" was ordered by MoTS RA in 2008. Financial assistance to the work was provided by the Asian Development Bank (ADB) as part of the Country Partnership Strategy. "The strategy 2020" was updated as the Transport Sector Master Plan. The Transport Strategy is included in the Armenia Sustainable Development Program 2014-2025, and a dedicated investment plan was developed. It includes 58 investment projects with the total cost estimated at about $2 billion, of which about $1.3 billion is for 49 new projects and $0.7 billion for 10 ongoing projects.
	Target End-use	Regulatory measure, feasibility studies
	Target Group	Road transport
	Regional Application	National
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	The 14 TA projects, at an estimated cost of $36.8 million, include feasibility studies for potential projects, advisory support for planning, technical knowledge transfer and institutional capacity development.
	Budget and Financial Source	The funding needs of development project are: Roads and road transport: $1,274.8 million Railways: $356.1 million Urban transport: $331.0 million Civil aviation: $104.3 million Total: $2,066.2 million
	Implementing Body	MoTS, Dedicated PIU
	Monitoring Authority	MoTS
Ene	**Method for Monitoring/ Measuring the Resulting Savings**	

	Savings Achieved in 2014 as per 1st EEAP (toe/year)	n/a
	Expected Energy Savings in 2017 (MWh/year)	n/a
	Expected Energy Savings in 2018 (MWH/year)	n/a
	Expected Impact on Energy Savings in 2020 (if Available) (MWH/year)	n/a
	Assumptions	
	Overlaps, Multiplication Effect, Synergy	

Title		**Dissemination of information on technologies and approaches for reducing energy consumption effectively**
Index of the Measure		**V.2**
Description	**Category**	V. Transport sector
	Timeframe	
	Aim/Brief description	Not yet implemented
	Target End-use	
	Target Group	
	Regional Application	
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	
	Budget and Financial Source	
	Implementing Body	
	Monitoring Authority	
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	
	Savings Achieved in 2014 as per 1st EEAP (MWH/year)	N/A
	Expected Energy Savings in 2017 (MWh/year)	N/A
	Expected Energy Savings in 2018 (MWH/year)	N/A
	Expected Impact on Energy Savings in 2020 (if Available) (MWH/year)	N/A
	Assumptions	
	Overlaps, Multiplication Effect, Synergy	

Title		Continuous exchange of mini buses by larger passenger buses
Index of the Measure		**V3**
Description	**Category**	Investments in public transport improvement
	Timeframe	1st Phase: Start 2005, End 2006. 2nd Phase: Start 2007, End 2013, 3rd Phase: Start 2014, End 2020
	Aim/Brief description	• Optimization of public RT route grid and reduction of annual running distance • Replacement of minibuses by larger ones, and • Overall modernization of public RT fleet.
	Target End-use	Yerevan Municipality
	Target Group	Yerevan Municipality, public transport companies
	Regional Application	Yerevan
Information on Implementation	**List and description of Energy-saving Actions Substantiating the Measure**	1. The first phase of strategy: In 2005-2006, first 131 new Euro-3 technology standard urban buses were put in operation, replacing 143 old Pre-Euro standard minibuses and several buses. Two new bus routes were introduced, replacing 5 minibuses routes (one canceled and 4 replaced). 2. The second phase of the strategy: Since 2007 and by 2013, the number of minibus public RT fleet was reduced by 1,758 vehicles,of which 1,536 were removed in the 2009-2013 period. In 2009 alone, 836 minibuses were put out of operation, which made that year a formative year for implementing the RT fleet optimization strategy's second phase. At the same time,the amount of minibuses reduced were replaced by 351 new urban buses, 9 different routes of minibuses were canceled and 20 routes of minibuses were replaced by public bus routes.
	Budget and Financial Source	Intergovernmental loans, "Cooperation of Sister Cities" Program, Green Crediting and Energy Efficiency loans through various national banks under WB, EBRD, KfW, GGF projects, Yerevan Municipality budget
	Implementing Body	MoTC, Yerevan Municipality
	Monitoring Authority	Yerevan Municipality
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	Bottom-up national methodology
	Savings Achieved in 2014 as per 1st EEAP (MWh)	821,022
	Expected Energy Savings in 2017 (MWh)	1,045,391
	Expected Energy Savings in 2018 (MWh)	1,118,245
	Expected Impact on Energy Savings in 2020 (MWh)	1,267,202

	Assumptions	1. The price of imported Russian natural gas will remain in the current low range. 2. Net calorific value of imported Russian natural gas is no less than 8,200 kcall/cub.m. Continuation of current trends in CNG/Diesel (gasoline) proportions for minibus and urban bus fleet and running distance reduction through the optimization of public transport run route-grid.
	Overlaps, Multiplication Effect, Synergy	Eurasian customs union impact on car import structure, EE lending financing new car purchases, road improvement impact on fuel efficiency

Implementation of the Yerevan public transportation fleet optimization strategy and replacement of minibuses by larger urban buses started in 2005. The main aims of strategy are to:

- optimize the public RT route grid and reduce the annual running distance of the fleet
- replace minibuses by larger ones
- achieve the overall modernization of the public RT fleet

First phase of implementation, 2005-2007. The first 131 new Euro-3 technology standard urban buses were put in operation, replacing 143 old Pre-Euro standard minibuses and several buses. Two new bus routes were introduced, replacing 5 minibuses routes (one canceled and 4 replaced). Even this modest start led to significant outcomes. Not only was the unsatisfied demand for public transportation in Yerevan visibly reduced (from 130 to 110 trip/person), but substantial energy savings were recorded, with 315,937 MWh in energy savings in 2007, in comparison with the case of not implementing of RT fleet optimization strategyorreplacing minibuses by larger urban buses.

Second phase, 2007-2013. The number of minibus public RT fleet was reduced by 1,758 vehicles, of which 1,536 were removed in the 2009-2013 period. In 2009 alone, 836 minibuses were put out of operation, which made that year a formative year in implementing the RT fleet optimization strategy's second phase. At the same time, the reduced amount of minibuses were replaced by 351 new urban buses, 9 different routes of minibuses were cancelled and 20 routes of minibuses were replaced by public bas routes. As a result, the total annual average running distance of the Yerevan public minibus fleet was reduced from 161 million km in 2010 to about 101 million km in 2014 (a 62.5% reduction).Energy savings of 389,837 MWh were achieved in 2010, in comparison with the case of not implementing of the RT fleet optimization strategy. In 2014, the energy savings increased to 821,022 MWh.
Third phase, 2015-2020 (time period considered under NIEP 2). Energy saving calculations for this phase are based on continuation of the current trends. From 2015 to 2020, another 1,020 minibuses are expected to be pulled from the public RT fleet, while the number of buses will increase with the addition of 468 new Euro 4 and higher technology standard buses. This would ensure 896,852 MWh in energy savings in 2015, in comparison with the case of not implementing of the RT fleet optimization strategyor replacing minibuses by larger urban buses. In 2020, the energy savings are expected to increase to 1,267,202 MWh.
The quality of energy savings assessment could be improved if more detailed information on activity data is available. Actual recordings of RT fleet running distances (daily and annual) is of paramount importance. Besides, completeness and accuracy of activity data (including a technical description of the RT fleet, data on specific fuel consumption by type and vehicle technology class (Pre-Euro and Euro standards, etc.) is of great importance, as well. It is also extremely important to ensure consistent and robust data gathering, recording and activation processes in place, and improve the institutional memory.
The fuel-switching of road transport is one of the largest shareholders of energy savings in the overall list of considered EE measures. The energy savings here could be even bigger, if over the 2015-2020 period, EEV or Euro-4 and newer technology standard urban CNG buses are introduced to replace old minibuses and Euro-3 and earlier standard urban diesel/gasoline buses. In addition, it should be kept in mind that environmental benefits of switching to CNG (reduction of hazardous emissions) in public transport

are far more significant (although currently not monetized) than the energy savings, though these benefits are important.

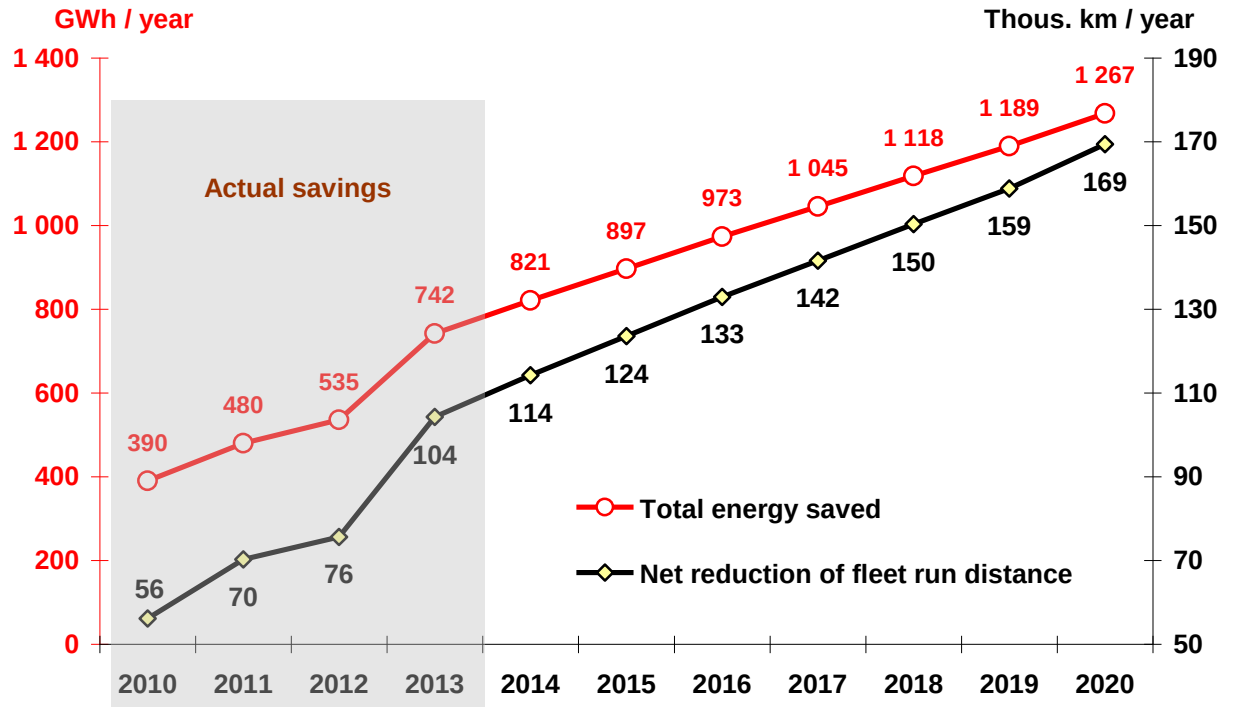


Fig. V3. 1. Yerevan Public RT Fleet RunningDistance Net Reduction (1,000 km) and Annual Energy Savings (GWh/year) via Implementation of the Fleet Optimization Strategy and Replacement of Minibuses by Larger Urban Buses. 2010-2013 Actual Savings.

EBRD and EIB Loan for Yerevan Metro Modernization		**EE Finance, Municipal Services**
Index of the measure		**V.4.1**
Description	**Category**	EE programs and measures, finance, municipal services, mobility, transport
	Timeframe	Start: 2015
		End: 2020
	Aim/Brief Description	EBRD Metro Rehabilitation aimed to increase the energy efficiency of passenger rolling stock.
	Target End-use	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)
	Target Group	Yerevan City
	Regional Application	National
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	• Rolling stock modernization: modernization and repair of rolling stock will save 390,258 kW on an annual basis. • Ventilation replacement: Replacement of worn-out and partially functioning ventilation systems at 10 stations will save 932,575 KW on an annual basis. • Escalator replacement: Replacement of worn-out escalators with modern ones at 10 stations will save 640 kW per hour. • Depot rehabilitation: Rehabilitation of depots equipped with worn-out and obsolete and partially functioning equipment will save a considerable amount of energy (quantification is not available), improve environmental situation through replacement of old stuff by using of modern, environmentally friendly materials, less polluting equipment, better treatment of lubricants and other waste maintenance materials.
	Budget and Financial Source	**EUR 37 million** provided by EBRD, EIB, Sovereign Loan, E5P Grant co-financing pending
	Implementing Body	EBRD, Yerevan Metropolitan after K.Demirhcyan
	Monitoring Authority	EBRD
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	EBRD internal procedures
	Savings Achieved in 2014 as per 1st EEAP (MWH/year)	
	Expected Energy Savings in 2017 (MWh/year)	5,294
	Expected Energy Savings in 2018 (MWH/year)	5,294
	Expected Impact on Energy Savings in 2020 (if Available) (MWH/year)	5,294

	Assumptions	No new lending volumes have been estimated beyond 2014, which is unlikely.However, it was not possible to make assumptions about future lending volumes since no lending forecast has been provided by EBRD.
	Overlaps, Multiplication Effect, Synergy	Due to the mixed nature of EBRD EE lending, there ae overlaps with all sectoral measures for which financing is made available.

EBRD and EIB Loan for Yerevan Metro Modernization		**EE Finance, Municipal Services**
Index of the Measure		**V.4.2**
Description	**Category**	EE programs and measures, finance, municipal services, mobility, transport
	Timeframe	Strat: 2015
		End: 2020
	Aim/Brief Description	Investment in trolleybuses in Yerevan is aimed at increasing energy efficiency of the passenger rolling stock.
	Target End-use	Public transport
	Target Group	Yerevan City Municipality
	Regional Application	Yerevan
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	Modernization of trolleybus fleet, electric substations and trolley contact network
	Budget and Financial Source	
	Implementing Body	Municipality, PIU
	Monitoring Authority	Yerevan Municipality
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	
	Savings Achieved in 2014 as per 1st EEAP (MWH/year)	N/A
	Expected Energy Savings in 2017 (MWh/year)	N/A
	Expected Energy Savings in 2018 (MWH/year)	N/A
	Expected Impact on Energy Savings in 2020 (if Available) (MWH/year)	N/A
	Assumptions	
	Overlaps, Multiplication Effect, Synergy	

Title		Expansion and modernization of rail transport network (passenger and freight).
Index of the Measure		**V.5**
Description	**Category**	Investments in rail road transport improvement
	Timeframe	Continuous (seasonal) activity
	Aim/Brief Description	Russian-owned UKZHD Company operates an electric train on the Yerevan (Almast) - Shorzha (YSY ET) extended route 6 times a week, which significantly unloads the road traffic of passengers usually taking personal cars or buses to Lake Sevan recreation zone. The share of passengers switching to rail transit varies between 18% and 20%.
	Target End-use	Rail road transport
	Target Group	Rail road transport fuel efficiency
	Regional Application	Regional
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	Prevented car (road transport) trips by operation of YSY ET, modernization of electric trains fleet (train types ВЛ8, ВЛ 10, ЭР2)
	Budget and Financial Source	Investments by UKZHD Company
	Implementing Body	UKZHD Company
	Monitoring Authority	MoTC
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	Energy savings from seasonal operation are based on the concept of “prevented car trips” by the passengers of YSY ET; otherwise,passengers need to use passenger cars or buses for their seasonal trips to L. Sevan.
	Savings Achieved in 2014 as per 1st EEAP (MWH/year)	582
	Expected Energy Savings in 2017 (MWh/year)	862
	Expected Energy Savings in 2018 (MWH/year)	972
	Expected Impact on Energy Savings in 2020 (if Available) (MWH/year)	1,206

	Assumptions	Operation of Russian-made electric trains with 1.5 fuel efficiency will continue up to 2016. Afterwards and until 2020, more modern trains with 1.71 fuel efficiency will be in operation (on YSY ET and elsewhere in Armenia). The savings have been assessed based on the avoided car trips have been estimated based on a blended mix of types of cars used by the given passenger group and the seasonality of this transit (summeronly).
	Overlaps, Multiplication Effect, Synergy	Significant multiplication effect will be achieved by overall modernization of electric trains fleet (98% of rail road grid in Armenia is electrified)

The energy savings from operation of YSY ET are based on prevented car trips to L. Sevan recreation zone each year during the summer periods. The Figure below highlights the obtained results.

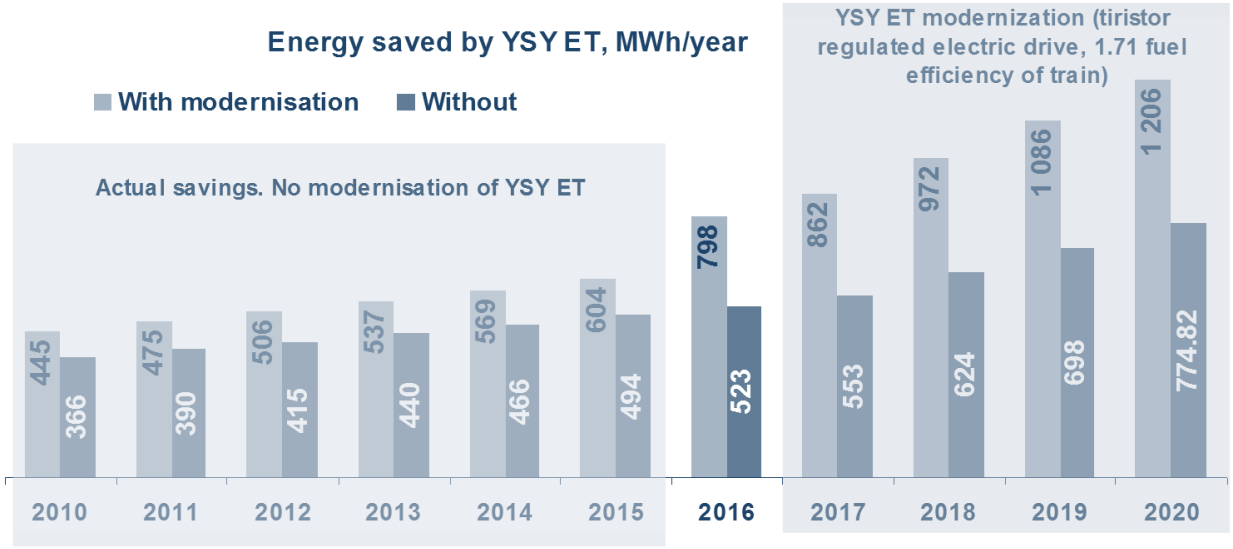


Fig. V5.1. Energy Savings by Operation of YSY Electric Trains (MWh/year) without and with Modernization in 2017-2020 aimed at increasing YSY ET fuel efficiency.

The quality of energy saving assessments could be significantly improved if more detailed information on passenger flow by each routewas available (e.g., Hrazdan-Charentsavan-Yerevan(Almast) and back, separately from Yerevan(Almast)-Sevan-Yerevan(Almast) seasonal route, as well as for regular routes: Yerevan(Central)-Tbilisi(Georgia)-Yerevan(Central),Yerevan(Central)-Gyumri-Yerevan(Central), Yerevan(Central)-Armavir, Yerevan(Central)-Artashat, etc.). If detailsare available about the "Concept Program of Passenger Transportation for 2012-2020" developed by UKZhd, they could be of great help.

Another very important portion of the activity data, currently unavailable in sufficient details, is related to the technical description of the stock of electric locomotives (with specific energy consumption information), drive-mode description of routes (average inclination, wasteful break portions of the routes and their distances), etc. It is also extremely important to ensure consistent and robust data gathering, recording and activation mechanisms, and improve the institutional memory.

The completeness of energy saving assessments of the considered measure could be essentially improved if more activity data becomes available for analysis. This is especially true in case of current activities of UKZhd CJSC, such as cargo transportation of mining products, seasonal round trips to Batumi (Georgian

Black see coast) from Yerevan Rail Station, Yerevan-Tbilisi (Georgia)-Yerevan and Yerevan-Gyumri-Yerevan round trips across Armenia.

As far as the assessment of energy savings from UKZhd planned future activities is concerned, more detailed information about transportation of coal for the Yerevan Thermal Power Plant (announced in 2013) and transportation of municipal solid waste to centralized regional MSW disposal sites (announced in 2014) would be of great importance. The future new passenger turnover projects have significant energy-saving potential. One of the most promising that should be considered is the “AeroExpress” project. According to UKZhd officials, under this project announced in 2012, it is planned to connect Yerevan Central Rail Road Station to the Zvartnots international Airport.

Title		Continuous switching of road vehicles from gasoline to compressed natural gas (CNG)
Index of the measure		**V.6**
Description	**Category**	Transport
	Timeframe	Continuous activity
	Aim/Brief Description	Switching from Gasoline/diesel fuel to CNG has significant potential to reduce GHG emissions in RA. The trend of the past 14 years shows a substantial growth in the number of vehicles working on CNG.
	Target End-use	Transport sector
	Target Group	Transport companies, municipalities
	Regional Application	National
Information on Implementation	**List and Description of Energy-saving Actions Substantiating the Measure**	Switching from Gasoline/diesel fuel to CNG
	Budget and Financial Source	Intergovernmental loans, Green Crediting and Energy Efficiency loans, Carbon finance, or Analogues of CDM (JI) projects under UNFCCC after 2015.
	Implementing Body	Transport companies, MoTC
	Monitoring Authority	MoTC
Energy Savings	**Method for Monitoring/ Measuring the Resulting Savings**	Bottom-up national methodology
	Savings Achieved in 2014 as per 1st EEAP (MWh)	N/A
	Expected Energy Savings in 2017 (MWh)	N/A
	Expected Energy Savings in 2018 (MWh)	N/A
	Expected Impact on Energy Savings in 2020 (if Available) (MWh)	N/A
	Assumptions	1. The price of imported Russian natural gas will remain in the current low range. 2. Net calorific value of imported Russian natural gas will increase from the current 8,200 kcall/cub.m to 8,500 kcall/cub.m. by 2020. 3. Carbon (CO_2) trade will continue after Dec. 2015 IPCC Paris summit.
	Overlaps, Multiplication Effect, Synergy	Eurasian customs union impact on car import structure, road improvement impact on fuel efficiency

No direct assessment of energy savings associated with this measure can be performed. Monetary savings from this measure are expected to be significant, and could be assessed based on the saved monetary value associated with switching to CNG by the Armenian RT fleet.

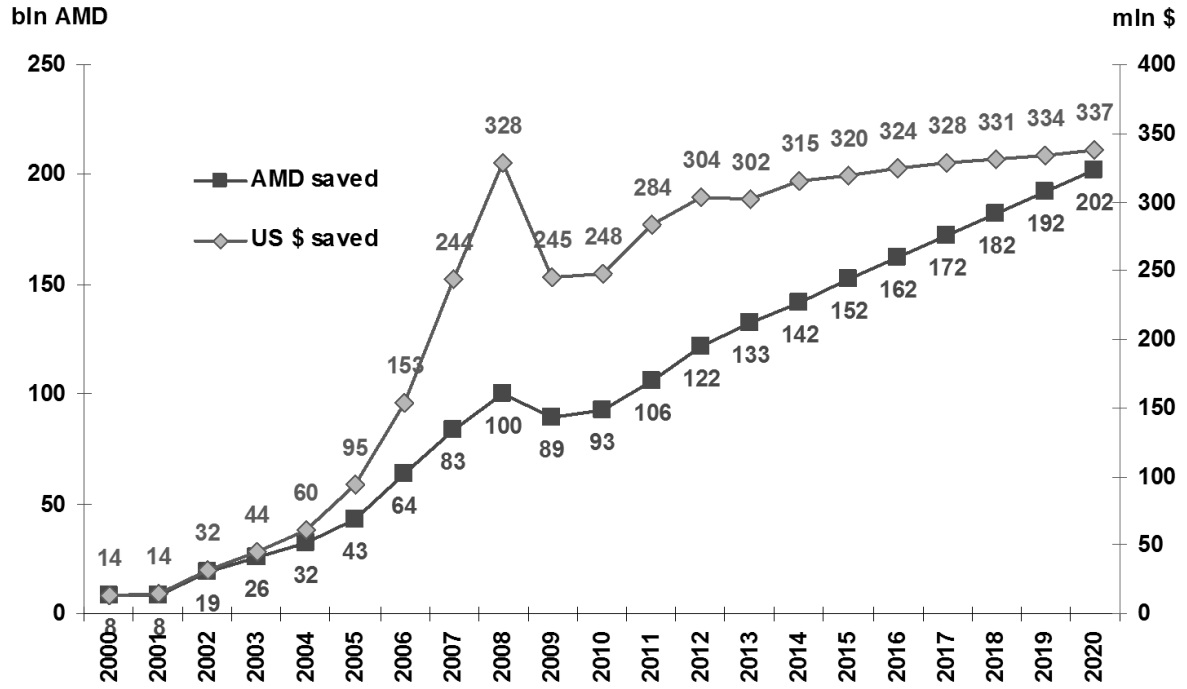


Fig. V6.1. Monetary Savings Associated with Switching to CNG of Armenian RT fleet, in billion AMD (right) and million USD (left).

Title		Development of an Integrated Electro-transport network and services to cover unsatisfied demand in public transportation services in the greater Yerevan area
Index of the Measure		V7
Description	Category	Public Transport
	Timeframe	• First phase:By 2025, 7-station new metro line with West HUB connecting metro with Zvartnots International Airport will be put in operation, which will double the metro annual turnover. • Second phase. by 2030 commissioning of ITEN new 9 station metro line with North HUB (to the cities of Abovian and Charentsavan, on the base of Almast Rail station). ITEN turnover will more than tripled in comparison with 2010 level. Annual electricity consumption will increase from current 120 mln kWh level up to 375-400 mln kWh in 2030.
	Aim/Brief Description	Significant public transport infrastructure development is needed in order to cover the unmet potential of public transportation services. Main focus here should be placed on the development of the integrated electro-transport network (IETN) for Yerevan agglomeration with essential expansion of Yerevan Metro.
	Target End-use	Transport sector
	Target Group	MoTC, Yerevan and suburban municipalities
	Regional Application	Yerevan agglomeration
Information on Implementation	List and Description of Energy-saving Actions Substantiating the Measure	Optimization of public transportation routes in Yerevan agglomeration (including Zvartnots int. airport, cities of Abovyan, Charentsavan and Edcmiadzin, replacing of motor (fossil fuel) based passenger traffic flow with electric based one. Reduction of overall trip distances by essential improving of logistic and development of feed-in routs
	Budget and Financial Source	Infrastructure loans (WB, IFC, ADB, EBRD, etc.), private-public partnership, GoA, Yerevan Municipality
	Implementing Body	GoA, MoTC, Yerevan Municipality, municipalities of the greater Yerevan area
	Monitoring Authority	MoTC, Interagency Project Implementation Unit
Energy Savings	Method for Monitoring/Measuring the Resulting Savings	Monitoring standards for transport infrastructure projects Implementation, developed by WB, EBRD, ADB, etc.
	Savings Achieved in 2014 as per 1st EEAP (MWh)	N/A
	Expected Energy Savings in 2017 (MWh)	N/A
	Expected Energy Savings in 2018 (MWh)	N/A
	Expected Impact on Energy Savings in 2020 (if Available) (MWh)	N/A

	Assumptions	1. Regional stability will be ensured. 2. Harmonization between the European and Eurasian integration processes will be achieved. 3. An attractive business environment for infrastructure loans will be created.
	Overlaps, Multiplication Effect, Synergy	Currently, several transport development strategies are in place, lacking overall synchronization of activities and absence of a unified approach.

Significant public transport infrastructure development is needed in order to cover the huge unmet demand for public transportation services in the greater Yerevan area. The main focus should be placed on the development of the integrated electro-transport network for the greater Yerevan area with an essential expansion of the Yerevan Metro.

1. Significant development of the public transport infrastructure by introducing an integrated electro-transport network (IETN) for the capital Yerevan with two transport hubs to the Zvartnots International Airport (West Hub) and to the cities of Abovian and Charentsavan (North Hub, based on Almast station in Nor Zeytun district of Yerevan, see V3 Report).
    - **First phase.**By 2025, a 7-station new metro line with West HUB connecting metro with the Zvartnots International Airport will be put into operation, which will double the metro annual turnover.
    - **Second phase**. In 2030, commissioning of ITEN new 9-station metro line with North HUB (to the cities of Abovian and Charentsavan, on the base of the Almast Rail station). ITEN turnover will more than triple in comparison with the 2010 level. Annual electricity consumption will increase from the current 120 million kWh level to 375-400 million kWh in 2030.
    - Energy savingsachieved from the implementation of this measure will be at least 3 times more than the savings from the V3 measure and will mainly occur after 2020. More detailed estimates should be made through a properly conducted analysis based on consistent and adequate primary data.
2. Encouraging import of gas-fired public transportation vehicles, electromobiles and hybrid cars (via duty and tax incentives).
3. Modernizing the electro-transport fleet; introducing modern Unified Ticket for Public Transport (including electro-transport, trolleybuses, metro, electric rail and urban busses)
4. Development of the related infrastructure (services, operation and maintenance).
5. Attracting direct investments and technology transfer, introducing private-public partnership mechanisms and establishing effective collaboration with local authorities are essential to accomplishing the strategic goals.
6. Developing the appropriate roadmap and action plan is crucial to the successful implementation of this measure.

Others components include: advertising of public transport use, promotion of the “sustainable green transport for cities” concept, introducing a modern ticketing system, including monetization of gains from increasing the sustainability of the transport sector and its level of independence from fuel imports.

It is hoped that the development of the ITEN in Armenia’scapital city will essentially help tap the significant potential of public transport services and bring the use of services to the 1989 level (185 trips per person annually) by 2030.

COMPETENT BODIES AND ASSIGNED ORGANIZATIONS

Energy efficiency policy has a pivotal role to play in Armenia's economy: It is essential for creating conditions for economic growth while improving energy security. By reducing the energy intensity of the national economic output, energy efficiency holds the key to maintaining a safe, sustainable and affordable energy supply, while meeting increasing energy demand and improving quality of life for the Armenian population. Under conditions of extreme import dependence for fossil fuels, energy that Armenia's citizens, businesses, and infrastructure *do not use* is the cheapest, cleanest, and most secure energy resource.

The potential for energy efficiency in all sectors has been assessed repeatedly and remains high, despite the relatively low energy intensity of the economy. The Armenian Government has promoted energy efficiency through various programs and policies, but the overall potential for efficiency improvement still remains largely untapped. With energy prices rising, the urgency of accelerating the uptake of energy efficiency throughout Armenia's economy has increased. The goal of the second National Energy Efficiency Action Plan (NEEAP) is to assess the effectiveness of ongoing efforts by the Government, donors, international financial institutions and the private sector to improve the efficiency of energy use since 2010, when Armenia's first NEEAP was developed. The second NEEAP also identifies barriers to more extensive efforts in this direction, proposes measures to help overcome these barriers, and offers additional energy efficiency improvement measures for the period covering 2015–2020.

The key pillars of the second NEEAP are:

- Reducing energy demand by improving the efficiency of energy end use;
- Improving national energy security by reducing the need for imported energy resources;
- Decreasing the energy content of the key economic outputs to reduce costs and raise the competitiveness of output;
- Addressing growing energy affordability concerns through energy efficiency solutions (instead of relying on social aid); and
- Providing impetus for behavioral change by decoupling growth from energy use, and thus enhancing the quality and sustainability of development through the introduction of knowledge and traditions for resource efficiency and smart growth.

The development and adoption of the Second NEEAP for the Republic of Armenia is one of the steps on the pathway upon which the Government of Armenia embarked a decade ago, by adopting Armenia's first Law on Energy Saving and Renewable Energy. The

Republic of Armenia developed its first NEEAP in 2010 to accelerate the implementation of its national energy efficiency policy. The first NEEAP set forth a set of programmatic and policy measures for energy efficiency improvement for all economic sectors of the country. The first NEEAP, adopted by Government Resolution #43 on 4 November 2010, set the country on track for a ten-year process with intermediate targets and interim evaluations. Because adequate data were not available at the time for developing targets based on statistics, the first NEEAP provided rough estimates of the potential impact of the proposed measures as fractions of the overall target up to 2020.

The successful implementation of the energy policy of the Republic of Armenia depends on the active engagement of all stakeholders in the sector. The realization of the secon NEEAP is a necessity. All planned measures should be implemented to achieve the anticipated results. None of them has a low priority, all individually and as a whole are necessary.

The application of EE measures reduces dependence on imports of primary and transformed energy, decreases environmental pollution, improving the living conditions of citizens (less pollution, better health conditions, lower energy costs), create new jobs.

While the Table 39 summarises the roles and responsibilities of the key stakeholders with respective investments necessary for each of the EE improvement measure, the role of the Ministry of Energy and Natural Resources (MoENR) must be additionally emphasized.

The existing organizational structure in the field of energy efficiency policy has been a priority measure in the first NEEAP and the NEEAP proposed establishment of an Energy Efficiency Agency. This activity was not implemented. *De facto*, R2E2 has been tasked with many functions of an EE Agency. The R2E2 is well positioned for this role, but the administrative capacities within MoENR are scarce with very limited capacity and cadre for the implementation of the national policy of energy efficiency. This situation of understaffed bodies responsible for the overall implementation and monitoring of energy efficiency policy can cause delays in the execution of the obligations. These capacities are also necessary to adequately pursue the legal-regulatory reform tasks and promotion

of the policy initiatives with the legislative bodies. Failure to do so will cause further delays in implementation of amendments of energy efficiency policy.

The competent bodies and assigned organizations are Development Department at the Ministry of Economy, R2E2 and the National Statistical Service.
The Ministry of Economy, oversees the entire industry and SME sector and is currently in charge of all energy efficiency-related issues related to standards and certification.
The Ministry of Agriculture must be in charge of programs related to irrigation, aquaculture, and greenhouses.
The Ministry of Urban Development (MUD) must continue to take the lead in housing poicy reform. MUD is also strongly understaffed. According to international best practices, when initiating reform, establishing a National Housing Agency could help speed up the process creating a viable financing scheme for MABs with the enrollment or the private sector.

The main tasks to be adopted by the MoENR or R2E2 related to the second NEEAP are the following:

- Develop and maintain appropriate and transparent data bases on energy efficiency and renewable energy sources (monitoring and reporting services).
- Monitoring, verification of savings and preparing reports on realized energy audits in building sector.
- Organize and monitor training courses for energy auditors.
- Cooperate with non-governmental sector in developing the awareness of the need of EE and RES.
- Encourage innovative approaches for investment including third party financing or co-financing.
- Undertake measures for raising the awareness of consumers on end-use heat efficiency and increasing the efficiency of MABs, insulation, efficiency of pumps, flow regulation and other distribution efficiencies can occur.

The National Statistical Service, in turn, must receive a permanent mandate for the debelopment and maintenance of the national energy balance on annual basis.

As an important step, the Government should establish a Watch Group –Committee (WG) to draw on private sector and community expertise during the implementing NEEAP and EE Strategy. WG an interagency group of experts from key stakeholders in the government, academia, public/non-governmental and private sectors, consumer groups, etc. will be established as a formal committee, adjascent to the Government, to convene on regular basis and discuss the direction and effectiveness of reform in energy efficiency and recommend actions, thus building a consensus among disparate energy efficiency

stakeholders, while providing a platform for public discussion and lobbying of new legal initiatives.

It can provide information to Government on lessons learned and best practice in implementing energy efficiency strategies which will underpin the long-term success of the Strategy. An organization such as this has proven to be critical to the success of other governmental energy efficiency programs.

Main tasks of the WG will be:

- Oversee existing and proposed Government funds and Grants .
- Engage stakeholders to enhance the effectiveness of existing and proposed funds and incentives (e.g. work with banking and property industry to increase awareness).
- Support national and sector specific information campaigns to increase awareness of energy efficiency options.
- Suggest, coordinate and enhance energy data collection.
- Report annually to Parliament on the effectiveness of all policies and measures and make recommendations for improvements.
- Engage with state and local authorities to encourage coordination, consolidation and collaboration of programs and policies.
- Lead a national program to stimulate EE skills, knowledge and work needed for a sustainable economy development.

The Board of Trustees of R2E2 is well positioned to perform these above roles.

Awareness and education of the stakeholders. Continuous consumer information is an important measure assumed before and during the implementation of NEEAP. Through it promote benefits for the application of EE measures. It envisage realization of education at all levels vertically, creating new working places and businesses and acquire new skills that are missing from the market by way of qualification which solves the problem of unemployment; mitigated problem outflow of educated people.

Crucial element for the realization of the envisaged action plan is providing the necessary funding. The efficient functioning of the NEEAP is of very high importance for the implementation of the state policy in the sector of energy efficiency.
The political decision through legal benchmark for compulsory implementation of energy efficiency measures in public buildings, paved the way to a successful implementation of the measures envisaged.

Incentive instruments for the implementation of EE measures are extraordinary impulse to potential investors. The measure of financial incentives for installing solar panels should

not remain single. Positive results have been achieved during participation in the cost of refurbishment of private housing by municipalities and donors (HABITAT / USAID).

The state needs to provide funds for financial assistance to industry, manufacturing and services in order to become more market competitive by the cheaper products, while simultaneously increasing quality, due to lower energy costs by adopting new technological processes. Donors' assistance in this direction is valuable, but should not be the only one in providing technical assistance on best available technologies, subsidizing energy audits and facilitating finance through commercial banks .

The below Table 39 summarizes the key NEEAP activities along with their responsible implementing entities, financiers and estimated funding needs.

Table 39. Competent Bodies and Assigned Organizations

No	Title of the energy saving measure	Duration	Status in relation to 1st EEAP	Implementing body	Required financing (US$)	Sources of financing
	Horizontal & Cross Cutting					
I.3.a.	Financing for Energy Efficiency: GGF	Start: 2014 End: 2020 (ongoing)	partially implemented	ACBA, ACBA Leasing, Ineco and Ararat Banks	15,354,000	GGF
I.3.b.	Financing for Energy Efficiency: IFC EE loans for households and SMEs	Start:2009 End: 2015	partially implemented	HSBC (industrial) and Byblos Banks (residential)	40,000,000	IFC
I.3.c.	Financing for Energy Efficiency: Energy efficiency loans for residential and business clients, EBRD ArmSEFF	Start:2006 End: 2015	partially implemented	ArmSEFF/Energocredit with 6 partner banks	28,000,000	EBRD
I.3.d.	Financing for Energy Efficiency: Eastern European Energy Efficiency and Environment Partnership (E5P)	Start: 2015 End: ongoing	initializing, tracked as part of other measures	E5P Secretariat (EBRD), MoENR	22,470,000	RA (1 M EUR), MoE Grant (20 M EUR) and E5P
I.6.	Removing inadequate gas tariff structure to encourage energy savings	Start: 2016, ongoing	not implemented	MoENR, PSRC	n/a	MoENR, PSRC
I.7	Support to Armenian Municipalities in Sustainable Energy Action Planning	Start: 2015; End 2020	new measure	Energy Cities support program COMO-East, CoM signatories	11,000,000	European Commission, Municipalities, other funds
	Buildings/Residential					
II.7	Legal Support, Financing and Information: Improvement of Energy Efficiency in Buildings; development of secondary legislation for EE in buildings, as well as funding for the first pilot thermal modernization of a residential multi-apartment building in Avan district of Yerevan and social housing in Goris and Akhouryan towns (UNDP/GEF BEEI project).	Start: 2013; End: 2017	partially implemented	MoNP, UNDP/GEF	1,200,000	UNDP/GEF
II.9.a.	Financing for Energy Efficiency: Household energy efficiency loans and EE mortgage loans (NMC/AFD)	Start:2014 End: 2020	partially implemented	NMC and 15 participating financial institutions (PFIs)	13,000,000	AFD
II.9.b.	Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	Start: 2013; End: 2018	partially implemented	HFHA, Inecobank, UCOs	3,629,507	USAID, European Commission
II.9.c.	Financing for Energy Efficiency: KfW Housing EE credit line	Start:2016 End: 2020	pending	NMC. Borrower: Central Bank of Armenia,	22,898,000	KfW

II.10	Mitigating Tariff Increase with Low-income Energy Efficiency Program	Start: 2015; End: 2016	new measure	MoENR; Ministry of Labor and Social Affairs	9,092,687	to be provided by Government of Armenia
II.11	EE Retrofits in existing residential buildings: National Program and Action Plan for MAB Renovation & EE	Start: 2016; End: 2020	new measure	Donors, IFIs/LFIs, PS, HOAs, ESCOs, MUD	25,000,000	IFIs TBD
II.12	Appliance Energy Labeling Awareness Campaign	Start: 2015 End: 2020	new measure	MoENR, producers and importers/distributors/suppliers of energy-consuming household appliances, and households	5,000,000	TBD
Public Buildings and Services						
III.1.	Financing for Energy Efficiency: Implementation of energy saving activities in municipal and social public facilities (R2E2/GEF/WB)	Start: 2012 End: 2017	partially completed	R2E2 fund, public institutions and ESCOs (a US$1.82 million GEF grant coupled with US$8.8 million in government cofinancing,)	10,700,000	R2E2 fund, public institutions and ESCOs (a US$1.82 million GEF grant coupled with US$8.8 million in government cofinancing,)
III.2.	NAMA New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2016 End: 2020 (ongoing)	partially completed	Ministry of Urban Development, Urban Development Projects Implementation Unit	24,000,000	international funding partner to be identified
III.3.	Financing for EE & Public Procurement for EE: UNDP Green Urban Lighting Project GHG Emission reduction by increasing energy efficiency of municipal lighting in the cities of Armenia	Start:2013 End: 2017	partially completed	UNDP/GEF, Municipality, Other (grant-funded)	452,670	UNDP/GEF, Municipality, Other (grant-funded)
III.4.	Financing for Energy Efficiency & Public Procurement for EE: EE-integrated reinforcement of Schools by KfW	Start:2016 End: 2020	pending	Borrower: Government of Armenia, represented by the Ministry of Finance Project Executing Agency: Ministry of Urban Development	15,000,000	KFW
III.5.	EBRD Loan-funded Yerevan streetlighting	Start: 2015; End 2017	pending launch	$4mln by EBRD loan, $2mln by E5P grant	6,000,000	$4mln by EBRD loan, $2mln by E5P grant
III.6.	USAID Clean Energy and Water Program for EE & RE solutions in community energy and water use	Start: 2012	completed	Mendez England & Associates (ME&A) Armenia	76,237	Mendez England & Associates (ME&A) Armenia
Industrial Processes and Power Sector						

IV.1	Considering energy efficiency aspects during approval and construction of new industrial facilities	Start: 2015 End: 2020 (ongoing)	not impemented	Academic institutions; Consulting organizations; Private sector, NGOs,Financial institutions; NSS	3,000,000	0
IV.2	Increasing the efficiency of the central heating plants and suppliers: Avan DH - cogeneration	Start: 2005 End: ongoing	partially implemented	UNDP	12,000,000	0
IV.3	Implementation of Energy Efficiency Financing Facility for Industrial Enterprises					
IV.4	Natural gas savings through improvement of transmission pipelines and substations, and optimisation of existing boiler houses in TPPs	Start: 2018End: 2020	not impemented	World Bank, MoENR	515,000,000	World Bank, MoENR
IV.5.a	Reduction of energy losses in distribution networks: WB Electricity Supply reliability	Start: 2015End: 2060	not impemented	MoE, WB	41,550,000	WB, GoA
IV.5.b	Reduction of energy losses in distribution networks: EBRD Power Supply Reliability	0	not impemented	MoE	70,000,000	EBRD
IV.5c.	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	Start: 2012 End: 2017	not impemented	MoE	25,000,000	ADB
IV.5.d.	Reduction of Electricity Losses in Low-voltage networks, ArmElNet	Start: 2016End: 2020	not impemented	ArmElNet	22,768,434	
IV.6	Wider Application of Renewable Energy: SWHs	Start: 2016 End: 2020 (and beyond)	new measure	MoENR, R2E2, KfW, AFD/NMC, GGF	-	TBD
IV.6.b	Geothermal Heat Pumps for Central Heating	Start: 2016End: 2020 (and beyond)	new measure	MoENR, Municipality of Jermuk, Vayotz Dzor Regional Administration	68,251	E5P, own resources, other
IV7	development of distributed RE generation through implementation of Net metering provision	Start: 2016 End: ongoing	0	GoA	66,000,000	0
Transport/Mobility						
V.1	Development of legislative background regarding fuel efficiency and emission norms of vehicles	Start: 2008 End: ogoing	partially implemented	0	2,066,200,000	0
V.2	Dissemination of information on technologies and approaches for reducing energy consumption effectively	0	not implemented	0	-	
V.3	Continuous exchange of mini buses by larger passenger buses	Start: 2012; End: ongoing	partially implemented	MoTC, Yerevan Municipality	34,200,000	Intergovernmental loans, "Cooperation of Sister

						Cities" Program, Green Crediting and Energy Efficiency loans through varios national banks under WB, EBRD, KfW, GGF projects, Yerevan Municipality budget
V.4	Expansion and modernisation of the electrified public transport system in the City of Yerevan	Start: 2015 End: 2020	partially implemented	EBRD, Yerevan Metropolitan after K.Demirhcyan	37,000,000	EBRD, EIB, Sovereign Loan, E5P Grant co-financing pending
		Start: 2016 End: 2020	pre-feasibility stage	EBRD, Yerevan Urban Lighting Co.	TBD -	EBRD, E5P, GoA
V.5	Expansion and modernisation of rail transport network (passenger and freight)	Start: 2010 End: Ongoing	partially implemented	UKZHD Company	funded as part of the Transport Sector Strategy portfolio	Investments by UKZHD Company
V.6	Continuous switching of road vehicles from gasoline to compressed natural gas (CNG)	Start: 2008; End: ongoing	partially implemented	Transport companies, MoTC	private sector, uncontrolled	Intergovernmental loans, Green Crediting and Energy Efficiency loans, Analoges of CDM (JI) projects under UNFCCC after 2015.
V.7	Development of Integrated Electro-Transport Network and services to cover unsatisfied demand in public transportation services in Yerevan agglomeration	Start: 2016; End: ongoing	-	ArmElNet	TBD	Infrastructure loans (WB, IFC, ADB, EBRD etc), Private-Public Partnership, GoA, Yerevan Municipality
Agriculture						
VI.1	Rural development program: high efficiency agricultural machinery import	Start: 2013 End: Ongoing	partially completed	State sector, SMEDNZ, MoA (MoA)	Not possible to be determined	MoA
VI.2	Importing high efficiency tractors, Japanese ODA	Start: 2010 End: 2012	implemented as planned	MoA, Japan Government	N/D	Japan Government
VI.3	Irrigation system enhancement project, wb	Start: 2013 End: 2017	partially completed	MoA, State Sector	33,100,000	World Bank
VI.4	Irrigation rehabilitation emergency project, WB	Start: 2009 End: 2013	implemented as planned	MoA, State Sector, World Bank	36,220,000	World Bank
VI.5	Community agricultural resource management and competitiveness project, WB	Start: 2011 End: 2016	partially completed	MoA, State Sector, World Bank	33,000,000	WB, GoA

VI.6	Municipal water project, WB	Start: 2012 End: 2015	partially completed	MoA, State Sector, World Bank	Not possible to be determined	MoA, State Sector, World Bank
VI.7	USAID Clean Energy & Water Program	Start: 2013-2014 End: Ongoing	implemented as planned	MoA, State Sector, World Bank	265,803	MoA, State Sector, World Bank
VI.8	Parakar Community Decentralized Wastewater Treatment, GEF Small Grant	Start: 2010 End: Ongoing	partially completed	MoA, State Sector, USAID	220,000	0
VI.9	Water Supply and Sanitation Sector Project	Start: 2012 End: 2017, Ongoing	partially completed	MoA, State Sector,ADB	36,000,000	ADB Financing
VI.10	Irrigation System Modernizaiton and Institutional Capacity Building, WB	Start: Future plans	new measure	MoA, State Sector,EDP, World Bank	44,000,000	0
VI.11	Agriculture and Rural Development, ENPI, ADA	Start: 2014 End: 2017	partially completed	MoA, European Union, ADA	41,000,000	0
VI.12	Science technology innovation partnership (STIP)	Start: 2014 Eng 2030	partially completed	MoA, USAID	3,000,000	0
VI.13	Energy efficient greenhouse	Start: 2011 End: 2020	partially completed	Armenian Harvest Promotion Centre	-	Armenian Harvest Promotion Centre
VI.14	Farmer education on irrigation management	Start: Immediately End: 2020	new measure	State sector, MoA, Ministry of Education	Not possible to be determined	MoA
VI.15	Grading agricultural products based on quality	Start: Immediately End: 2020	new measure	State sector, MoA	N/D	Ministry of Economy MoA
VI.16	Renewing the agricultural machinary park	Start: Immediately End: 2020	new measure	State sector, MoA	N/D	MoA
VI.17	Establishment of agricultural groups/cooperatives	Start: Immediately End: 2020	new measure	State sector, MoA	-	MoA
VI.18	Install gravity irrigation	Start: Immediately End: 2020	new measure	State sector, MoA	-	MoA
Grant Total		6,870,375 590.75	MWh ktoe		$ 3,338,265,588	

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