



National Energy Efficiency Action Plan 2010

REPUBLIC OF ARMENIA

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Executive Summary

Energy Efficiency – a Government Priority

The Government of Armenia prioritizes energy efficiency as a means of increasing the country's energy security, increasing economic competitiveness and reducing the negative impact on the environment. The Government's commitment and principles to promotion of energy efficiency are given in the *Law on Renewable Energy and Energy Efficiency* (2005) and the *National Program on Energy Saving and Renewable Energy* (2007).

Armenia has significant potential for energy efficiency and can recoup sizable economic benefits through utilization of this potential. Although its economic activity is less energy intensive than compared to other economies in the region, large potential remains for further efficiency improvements (up to 5% of the country's GDP, as was estimated in a World Bank study in 2008).

The highest economic effectiveness is envisaged through energy efficiency investments in the public sector. Other dominant sectors to be considered are the residential sector (buildings), industry, energy production, transport and agricultural sector.

Creating an Enabling Environment for Energy Efficiency

The main issue to realise the significant energy saving potential in the country's economy is the creation of an enabling environment for energy efficiency and financing of energy efficiency investments. This is mainly linked to a strong policy and to regulatory measures that need to be implemented and enforced. Beside that, there is great unawareness and lack of information in all sectors (from private households to industrial enterprises) what to do in regard to reducing energy intensity and specific demand. The country is looking for the introduction of appropriate market-based incentives for energy efficiency that are a necessary condition to diversify Armenia's energy supply and thus improve economic competitiveness.

This National Energy Efficiency Action Plan (NEEAP) is another attempt following different programmatic activities in the past years to making energy efficiency happen. Although the country does have a Law on Energy Efficiency and Renewable Energy since 2005 and a National Program on Energy Saving and Renewable Energy since 2007, basic measures formulated in these two documents have not been implemented so far. The NEEAP is therefore consolidating a set of measures for all relevant economic sectors in the country and specifying the need for action, especially on the political level. It shall provide the Government of Armenia with a bundle of activities to be realised with different priorities in the considered period 2010 to 2020.

The NEEAP focuses on five main economic sectors

The NEEAP is proposing a set of relevant measures to the Government of Armenia for improving the current legal status and enforcement of legislation put in place, for

capacity-building (mainly in the public sector) and institutional setting, for creating awareness across all sectors and a general environment that is more in favour of energy efficiency improvement in the following sectors:

- residential buildings
- public and private service sector
- industry & energy production
- transport
- agriculture

All in all, 31 relevant measures have been proposed within the NEEAP, all of them described in chapters 4 (horizontal and cross-sectoral measures and 5 (sectoral measures)

The overall time frame for implementation of the action plan is considered to be a period of ten years, from 2010 until 2020. This is also in line with action plans of other countries.

Indication of Potential EE Targets

For the purpose of the first NEEAP presented here, intermediate national energy savings targets have been proposed. These intermediate targets shall provide an indication of realistic savings as a percentage of the baseline demand to be achieved in the relevant target year, consistent with the overall national indicative energy savings target. However, a more detailed analysis of potentials and corresponding energy savings requires in all sectors is necessary, to provide a better data base and solidify the assumptions made regarding the EE potentials.

Lack of Basic Statistical Data

One important deficiency is the missing of a detailed annual energy supply and demand survey for all main sectors of economy that provides data on the annual final inland energy consumption of all energy users for the most recent years, including data on:

- energy supply (import, production, inventory changes)
- energy transformation (primary and secondary transformation processes)
- final energy demand of all relevant sectors
- useful energy demand according user categories (residential heating, industrial heat demand, stationary engines, lighting, air-conditioning, etc.)

Due to the missing basic data and with the information made available from different sources, it is at the moment not possible to draw a realistic baseline scenario that will provide a sound base to estimate absolute savings to be achieved in the target year.

Therefore, this first NEEAP provides only an indication of annual savings in relative terms (% p.a.) compared to the energy demand of the relevant sector (to be defined)

where the proposed measures is part of.

They are shown in the following table and further explained in the chapters 4 and 5.

Table 1: Estimated energy savings cumulated for each sector until 2020

Energy saving target adopted in 2020:		
Residential/Households	in %	23,0%
Industry & Energy sector	in %	23,3%
Transport	in %	20,3%
Public and commercial services	in %	14,6%
Water sector	in %	14,0%

Source: own calculation

As soon as detailed energy balances will become available, i.e. final energy demand per sector (in absolute terms), the second NEEAP (2014) will have to update this information and provide relevant data on the calculation of the national energy saving target for the year 2020 as well as intermediate targets for the years 2013 and 2017, as proposed in the template provided in Annex 1.

Evaluation and Monitoring of Progress Made

One important issue is to address regular monitoring and evaluation of measures in line with the proposed time frame, to assess if the intermediate energy savings targets are being achieved or if increased efforts are to be made to get back on the implementation path.

It is therefore foreseen that the Ministry of Energy and Natural Resources shall submit to the Government updated NEEAPs:

- a second NEEAP not later than 30 June 2014 (considering implementation status until end 2013),
- a third NEEAP not later than 30 June 2018 (considering implementation status until end 2017),
- and a fourth NEEAP not later than 30 June 2021 (considering implementation status until end 2020).

The 1st NEEAP – High Priority Measures until 2013

The measures proposed in the National Energy Efficiency Action Plan have been categorised into “high”, “medium” and “low” priority. Main criterion for the high prioritisation is the available energy saving potential with possible low funding implications (“low-hanging fruits”) or eventually already secured donor funding. These measures are to be implemented within the first implementation period until 2013. A summary of all high-priority measures proposed in the first NEEAP is given in the following table.

No	Title of the EEI measure	Responsibility	Duration
I. Horizontal Measures			
I.1	Implementation of a regular national "Energy Statistic" (with annual updates)	Ministry of Energy National Statistics Office	2010 - 2013
I.2	Implementation of a "National Energy Agency for Energy Efficiency and Renewable Energy"	Ministry of Energy	2010 - 2013
I.3	Financial Support for Energy Efficiency measures in all sectors	Ministry of Energy	2010-2013
I.4	Information campaigns, training and education in the area of energy efficiency improvements	Ministry of Energy (later: National Energy Agency)	2010-2020 ongoing process
I.5	General regulatory demand side measures	Ministry of Energy, Public Service Regulatory Commission	2010-2012
I.6	Assessment of the economic rationale of measures proposed in the NEEAP	Ministry of Economy	2010-2012
II. Building Sector			
II.1	National Building Code considering energy performance of buildings	Ministry of Energy, Ministry of Economy, Ministry of Urban Development	2010 - 2012
II.2	Standards and calculation methodology to assess energy performance in buildings	Ministry of Energy, Ministry of Economy, Ministry of Urban Development	2010 - 2012
II.3	Institutional capacity-building for implementing and enforcing new standards	Ministry of Urban Development	2010 - 2012
II.4	Establishing quality assurance/quality control (QA/QC) standards that will support the certification of key building materials for energy performance.	Ministry of Urban Development, Ministry of Economy	2010 - 2012
III. Public & Private Service Sector			
III.1	Information campaigns on several issues of energy efficiency to be applied in public and private service buildings	Ministry of Energy, National Energy Agency	2010 - 2020 (continuous activity)
III.2	Efficient energy services in public facilities - investive measures	Ministry of Energy Public and private service facilities' operators	2011 - 2013
IV. Industry & Energy Sector			
IV.1	Considering energy efficiency aspects for the construction of new industrial facilities	Ministry of Economy, Ministry of Environment PSRC	2010 - 2012
IV.2	Implementation of Energy Efficiency Financing Facility for Industrial Enterprises	Ministry of Energy, (with support from European Bank for Reconstruction and Development)	2010 - 2015
IV.3	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	Ministry of Energy, Electric Networks of Armenia	2010-2020
V. Transport Sector			
V.1	Vehicle Inspection and Maintenance (I&M) program	Ministry of Transport, Ministry of Economy	2010-2018
V.2	Traffic Demand Management (TDM) scheme	Ministry of Transport, Ministry of Economy	2010 - 2012
V.3	Dissemination of information on technologies and approaches for reducing energy consumption effectively	Ministry of Transport	2012 - 2020
V.4	Continuous exchange of mini buses by larger passenger buses operated by natural gas	City of Yerevan	2010 - 2020
VI. Water Sector			
VI.1	Utilization of gravity flow in irrigation systems and modernisation of existing pumping stations and upgrading secondary and tertiary canals	Ministry of Agriculture, Ministry of Energy, Water Committee (under Min. of Territorial Administration)	2010 - 2012

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List of Abbreviations

AEAI	Advanced Engineering Associates International
AMD	Armenian Dram
ArmSEFF	Armenian Sustainable Energy Financing Facility
BAU	business as usual
CEE	Central & Eastern Europe
CEEP	Commercialization of Energy Efficiency Project
CO ₂	Carbon dioxide
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
ENP	European Neighbourhood Policy
ESCOs	Energy Service Companies
ESMAP	Energy Sector Management Assistance Programme (of the World Bank)
EU	European Union
GDP	Gross Domestic Product
GEF	Global Environment Fund
Gg	Greenhouse gas
GHG	Greenhouse gas
IBRD	International Bank for Reconstruction and Development
IDA	International Development Agency
IEA	International Energy Agency
IFI	International Financing Institution
IMF	International Monetary Fund
KfW	„Kreditanstalt für Wiederaufbau“ Bankengruppe (group of banks)
Kg	kilograms
kWh	kilo Watt hours
LULUCF	Land Use, Land-Use Change and Forestry
MCA	Millennium Challenge Account
mt	million tonnes

mtoe	million tonnes equivalent
NEEAP	National Energy Efficiency Action Plan
NGO	Non-Governmental Organization
NOx	Nitrogen oxide
PSRC	Public Services Regulatory Commission
QA/QC	quality assurance / quality control
R2E2	Armenian Renewable Resources and Energy Efficiency Fund
SEFF	Sustainable Energy Financing Facility
SEI	Sustainable Energy Initiative
SMEs	small and medium enterprises
TJ	Terra Joule
TRACECA	TRAnsport Corridor Europe-Caucasus-Asia
TWh	Terra Watt hours
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
WB	World Bank

1 Introduction

1.1 Trends in Promoting Energy Efficiency

In 2008 the World Energy Council published a paper about “*Energy Efficiency Policies around the World: Review and Evaluation*”. In this study it is shown that in most world regions the amount of energy used per unit GDP is decreasing steadily: 1.6% p.a. on average at the world level between 1990 and 2006. Since 2000, this trend has however slowed down significantly, to slightly less than 1% p.a.

Industry is the main sector driving energy intensity reduction in industrialized countries. In developing countries and economies of transition, on the other hand, households are very often the main drivers. In China and the CIS, energy productivity improvements were almost equally driven by industry, energy conversion and households.

There are a few significant questions to consider when planning about EE improvement: What is the importance of energy efficiency measures? What are the priorities? What are the trends? How to introduce an adequate policy level to foster implementation of EE measures? And how to stimulate energy efficiency innovation cost effectively?

The main factors for stimulating energy efficiency measures observed are:

- Institutional background: Almost all countries have set up specific institutions dealing with energy efficiency, such as energy efficiency agencies, either at the national level, or at regional levels or both, and more recently at local level. Although the legal status of these agencies is different from one country to another, their establishment almost everywhere clearly indicates that there is a need for having a driving institution taking the lead on EE activity.
- A proper regulatory framework, with a specific bundle of energy efficiency legislation and/or national programmes taking into consideration quantitative, measurable, targets for energy efficiency improvements, can provide a long lasting context for energy efficiency policies and avoid the negative effect of “stop and start” actions: many countries have already set up quantitative targets, with annual monitoring requirements.
- Electrical appliances and buildings continue to be the main target for regulations and are spreading to a larger number of countries. In Europe, regulations represent about 40% of the measures implemented in the residential sector.

All European countries and most other OECD countries have energy efficiency standards for all new buildings. Some non-OECD countries outside Europe have recently established standards for service buildings. Altogether, about 60% of the countries surveyed had mandatory or voluntary standards for new non-residential buildings.

The few evaluations studies of the savings achieved with building codes show that the actual savings for new buildings are lower than the potential theoretical savings. This can be attributed to non-compliance with standards and changes in behaviour.

A more recent trend is to extend regulations to existing buildings (mainly stricter codes referring to thermal quality standards and introduction of energy efficiency certification of existing buildings).

- Labelling and standards apply to a growing number of electrical appliances. Labelling programmes and efficiency standards are an effective method of transforming the market and slowing the electricity demand growth. Labelling programmes introduced in developing countries are based on the experience of OECD countries and use models that have already been proven: the European label has been used as a model in Brazil, Tunisia, China and Iran, while labels introduced in Thailand and the Korean Republic are based on some Australian model.

Energy labels and standards are complementary tools. Labelling acts as an incentive for manufacturers to differentiate themselves from their competitors and stimulates the introduction of new, more efficient models. Standards remove from the market the less efficient appliances. To be effective, labelling programmes and performance standards must be regularly updated.

- Energy pricing is an important component of EE policies. Adequate pricing is a necessary condition for promoting energy efficiency. One of the first steps of any energy efficiency policy should be to adjust energy prices to more “real” market levels in order to give correct signals to consumers, whilst maintaining incentives for behaviour changes or to acquire energy efficient equipment and technologies.

Energy producing countries often maintain low domestic prices, which lead to intensive energy uses, as was seen previously by the high and increasing energy intensities in these countries. A reduction in the subsidies could lead to energy savings that could be sold at a much higher price on the international market and bring benefits to these economies.

Adequate pricing means establishing consumer energy prices that reflect the cost of energy supply, i.e. the long-term marginal cost for electricity, the long-term price of oil products on international markets for fossil fuels. Although most energy planners agree with such objectives, they often face reluctance and opposition from decision-makers outside the energy sector, who fear public resistance and the impact of energy price corrections on the consumer price index. Also, energy is a basic good for which a low price is a condition for low-income households access. This makes actual price adjustments slow or impossible in many developing countries, especially in the household sector.

- Financial incentives rely more and more on tax incentives than on direct

subsidies. Nevertheless direct subsidies on energy efficiency investments remain popular. As they have often been considered as costly and questionable, they are now better targeted. Subsidies are viewed as a temporary measure to mobilise consumers, to prepare for new regulations, or to promote energy efficient technologies by creating a larger market than would exist otherwise, with the objective of a cost reduction for the subsidised energy efficient technologies.

- Fiscal incentives, such as tax credits, tax reductions and accelerated depreciation, are usually considered cheaper than direct subsidies, especially to households, as they have lower transaction costs. They can work well if the tax collection rate is sufficiently high: such measures usually perform poorly in an economy in recession or in transition. They are more adapted to well-developed countries: so far, mainly OECD countries have implemented such fiscal measures. Tax reductions on energy efficient equipment or investments have been introduced in many countries and almost equally in all regions: they are used in about 30% of the countries surveyed.
- One of the main barriers to energy efficiency is the lack of information to consumers about what they can do. To address this issue, a large range of tools has to be designed: e.g. general information campaigns, labelling of appliances and even dwellings rating their energy performance, audits, local information centres, education campaigns in schools and universities, case studies, and comparative information.
- Audit schemes are a practical way of informing consumers about the possible actions to improve energy efficiency. They have been mainly developed in industry and in non-residential buildings and are increasingly made mandatory. Energy audits usually are partially funded by public agencies or by utilities in European countries and are more often free for consumers in the other regions to encourage participation.

Mandatory audits – like voluntary audits - assume a certain quality of the auditors as well as of the staff responsible for energy management in the companies (energy managers). This can be assured by the certification of the auditors and by the training of energy managers.

- ESCOs (Energy Service Companies) and EPC (Energy Performance Contracting) are a very attractive mechanism to capture cost-effective energy-efficiency potentials worldwide, mainly because they do not involve either public expenditure or market intervention. EPC can probably be considered among the most effective mechanisms for promoting energy efficiency in the public sector and, especially in developing countries, in the industrial sector.
- Several countries are introducing green taxes either on purchase tax or annual tax dependent on the CO₂ emissions or energy efficiency of the cars. Fuel taxation plays a key role in promoting more efficient vehicles and more sensible

driving habits. Tax increases are not always motivated by energy efficiency only. In some countries, specific CO₂/environmental taxes have been set up for motor fuels (e.g. Scandinavia and Germany). Green taxes are better accepted by the population, especially if part of the revenue is used to support energy/CO₂ efficiency measures. Road pricing indicates an efficient way to enhance the energy efficiency in transport, such as; the congestion charge in London.

- Energy efficiency obligations have been a success in the EU Member States. They have been shown to work in both monopoly and fully liberalised environment, both for supply and distribution companies.

Energy efficiency obligations are attractive also to governments, as they do not have to support the cost of these obligations. Energy efficiency obligations could be an important policy option for developing countries to save electricity, as they offer a way for governments to tackle energy efficiency at a modest increase on electricity customers' bills. Energy efficiency obligations for utilities are a promising market-based instrument.

- Quality labels and technical standards are effective tools for maintaining or improving quality, provided they are successfully enforced (e.g. the Keymark certification scheme in Europe). The existence of independent certification centres is a key element to ensure that imported products comply with national standards. The existence of skilled installers and of appropriate network of after sales services is also essential for stimulating further dissemination of solar water heating.

As a summary, **the introduction and/or strengthening of energy efficiency policies are becoming increasingly important and a sustained effort will be required over the long term. To be successful, energy efficiency programmes need to be based on appropriate strategies**, including for example:

- The public sector needs to commit itself to EE and lead by example.
- Need for a favorable and stable institutional framework.
- Energy efficiency policies should address all areas with energy savings potentials.
- To be efficient and cost-effective, regulations need to be well planned, regularly strengthened and properly enforced.
- Adequate pricing: a condition for successful energy efficiency policies' implementation to reflect more near-market conditions.
- Public/private partnerships to reinforce the effect of public policies.
- Quality of energy efficiency services and equipment should be strengthened through certification and testing facilities.

- Innovative measures should be promoted based on suitable experiences elsewhere.
- Regular monitoring and evaluation of implemented measures using indicators should be ensured.

1.2 Energy Efficiency – the issue for Armenia

The Government of Armenia prioritizes energy efficiency as a means of increasing the country's energy security, increasing economic competitiveness and reducing the negative impact on the environment. The Government's commitment to promotion of energy efficiency is mainly reflected in the *Law on Renewable Energy and Energy Efficiency (2005)* and the *National Program on Energy Saving and Renewable Energy (2007)*. The Law lays out the principles of the government's policy and governance structure supporting energy efficiency, and provides for energy efficiency standards, audits and awareness raising. The National Program on Renewable Energy and Energy Efficiency identifies the sectors with the largest energy efficiency potential and provides an outline of technical measures/solutions to be taken to realize the identified technically viable potential.

Armenia has significant potential for energy efficiency and can recoup sizable economic benefits through utilization of this potential. While Armenia is one of the less energy intensive economies in the region, largely due to the structural changes of the economy, large potential remains for further efficiency improvements.

Based on the National Program on Renewable Energy and Energy Efficiency, the World Bank performed a study in 2008¹ which identified significant economically and financially viable energy efficiency potential.

The study found that Armenia could save about 132 billion Armenian Drams (more than US\$360 million) annually, equivalent to almost 5 percent of its GDP, through energy efficiency investments. The above study also identified a number of informational, legal, regulatory and financial barriers impeding energy efficiency investments. There is an estimation that the economic and financial returns of **energy efficiency investments in public buildings have the highest return** with paybacks of two to eight years. Investments in energy efficiency of public buildings cannot only free up the fiscal space, but also prime the market, by creating demand for energy efficient equipment and services and send a strong signal to the private sector and general public about the Government's commitment to energy efficiency.

¹ "The Other Renewable Resource: The Potential for Improving Energy Efficiency in Armenia". July, 2008.

To aid the implementation of the National Program, the Government of Armenia requested the World Bank to support with creation of an enabling environment for energy efficiency and financing of energy efficiency investments of public buildings. The proposed lending and TA project will contribute to achieving the Government's national priorities as it will help generate awareness of the benefits of energy efficiency investments, address other information and data gaps related to energy efficiency, remove institutional and regulatory barriers, address capacity weaknesses hindering the implementation of energy efficiency measures, and provide financing for energy efficiency investments in the public sector, drawing on the recommendations of the National Program.

Moreover, energy efficiency is a key reform area for the development policy lending operations of the World Bank in Armenia. Under the development policy operation, the Government committed to adopt a time-bound **Energy Efficiency Action Plan (NEEAP)**.

For the development of the action plan, an international consultant was hired by the Ministry of Energy and Natural Resources in summer 2010, and the elaboration of measures proposed in the following report conducted in a process of involving stakeholders from different ministries (Ministry of Energy and Natural Resources, Ministry of Economy, Ministry of Urban Development, Ministry of Natural Protection), the Public Services Regulatory Commission, Armenian Renewable Resources and Energy Efficiency Fund, the Energy Institute, utilities, the World Bank, UNDP/GEF Armenia office, and gas and electricity companies.

1.3 Scope and Objectives of the NEEAP

The main objective of the action plan is to contribute to the formulation of the future energy policy of Armenia and to define concrete steps for its implementation. One of the main aims of the national policy in the energy sector is defined to improve energy efficiency and to further develop the use of renewable energy sources.

The mentioned Law on Renewable Energy and Energy Efficiency and the National Program on Renewable Energy Efficiency and Renewable Energy provide general policy measures and an assessment of energy saving potentials, however they have not been implemented so far.

The **National Energy Efficiency Action Plan** is based on generalised past trends in energy consumption and presumes a further rise in energy demand up to 2020. It takes into consideration earlier potential assessments made for energy savings in different sectors of the economy and refers to past and current projects/programmes dealing with energy efficiency issues and the main barriers to energy conservation. However, it was not the task during the NEEAP preparation to investigate into the sectoral potentials or even verify existing data, neither regarding energy efficiency nor economic potentials. The action plan is rather to be understood a *policy implementation*

programme to help overcoming institutional, regulatory and information barriers, to help the government to focusing on the most relevant actions to be taken in a short, medium and longer term perspective.

The diverse projects referred to in the previous paragraph are an important inflow of funds and financial sources into the country, especially in regard to technical assistance, rehabilitation and new infrastructure investments and as well awareness and capacity-building measures. The NEEAP is building upon these programmes/projects and proposes concrete measures per sector as well as horizontal and cross-sectoral measures together with quantitative targets (in %) that can be achieved by 2020. These targets need to be compared to a baseline energy demand that considers the average demand for the 3-years period 2008-2010.

However, the first stage of the Action Plan presented here is not able to take into consideration actual figures regarding final energy demand across all relevant sectors of Armenian economy. The problem lies mainly in the unavailability of reliable up to date statistical information on final energy demand in considered sectors. It is therefore been proposed to the Ministry of Energy and Natural Resources to define the baseline energy demand during the first NEEAP implementation period (until 2014, see 2.1) and provide the necessary data background together with a second NEEAP to be submitted by 2014, while ensuring this crucial measure, the elaboration of national energy statistic will be implemented as soon as possible.

1.4 Relevant Activities and Programmes related to Energy Efficiency in Armenia

To encourage energy efficiency, Armenia has so far taken several steps on the political and programmatic level:

- Started to create a legal framework for energy efficiency. In 2005, the Government passed a Law on Energy Savings and Renewable Energy, and has since signed the Intergovernmental standard draft building codes (for new buildings) which mandate energy efficiency but has not adopted it yet.
- Developed a National Program on Energy Savings and Renewable Energy with solid data on energy use and energy efficiency in Armenia.
- Has taken steps to improve the economic efficiency of energy use through improved regulation of energy utilities. Several barriers to economic efficiency which also affect the efficiency of energy resource use—for example, highly subsidized energy tariffs, or the absence of electricity and gas metering—have been largely removed in Armenia.
- Continued to work actively with development partners like the World Bank, the UN Development Programme, the EBRD, USAID and other donors on energy efficiency programs to improve the energy supply infrastructure (electricity and heat production facilities, transmission and distribution networks) and heat energy use in public and

residential buildings.

Relevant projects and programs ongoing and of past were mostly financed with support of the above mentioned IFIs that contribute to the implementation of an institutional and policy environment in favor of energy efficiency in Armenia:

GEF Program:

- Armenia – Improving the Energy Efficiency of the Urban Heating and Hot Water Supply (UNDP)
- Armenia Energy Efficiency Project (IBRD)
- LGGE Improving Energy Efficiency in Buildings (UNDP)

World Bank:

- Urban Heating Project – Armenia
- Electricity Supply Reliability and Energy Efficiency Project

INOGATE Programme:

- Harmonization of gas and oil technical standards and practices (E. Europe and Caucasus)
- Capacity-building for Energy Regulators in Eastern Europe and Central Asia
- Capacity building for Sustainable Energy Regulation in Eastern Europe and Central Asia
- Harmonization of electricity standards

EBRD:

- Armenian Sustainable Energy Financing Facility (ArmSEFF)

USAID:

- Commercialization of Energy Efficiency Project (CEEP)

International Finance Corporation:

- Armenia Energy Efficiency Survey Project

Millennium Challenge Account–Armenia (MCA–Armenia):

- Irrigated Agriculture Project

A more detailed list with a short description of the mentioned projects is provided in the Annex 3: List of relevant donor projects and programs ongoing and of past of this document.

2 Defining Targets for the Implementation of the NEEAP

Armenia can save greatly by investing in energy efficiency. As mentioned above, previous studies made by the World Bank estimate the realizable saving potential to some 5 percent of its GDP. This is equal to energy savings of approximately 1.21 mtoe annually, or 1 TWh of electricity and 600 million m³ of natural gas (based on 2008 demand).

Apart from the generated energy and cost savings, energy efficiency is one necessary condition to diversify Armenia's energy supply and thus improve economic competitiveness. And this can be achieved at less cost than investing into new production capacities or energy imports. Energy efficiency investments are in general economically and financially viable, especially the public sector investments provide the highest return on investment overall.

2.1 *Setting the path for Energy Efficiency in Armenia until 2020*

The action plan is proposing a set of relevant measures to the Government of Armenia for improving the current legal status and enforcement of legislation put in place, for capacity-building (mainly in the public sector) and institutional setting, for creating awareness across all sectors and a general environment that is more in favour of energy efficiency improvement in the following sectors:

- residential buildings
- public and private service sector
- industry and energy sector
- transport
- water sector

The overall time frame for **implementation of the action plan** is considered to be a period of ten years, **from 2010 until 2020**. This is also in line with action plans of other countries. Due to the fact that several measures have a longer duration, e.g. considering enforcement periods or reaction time until market actors are 'ready' to implement energy saving measures in the mentioned sectors, the action plan needs to distinguish short term, medium and long term planning:

- Short term measures: referring to an implementation path during a **first implementation period of the action plan from 2011-2013**. They refer to immediate action required in regard to policy making, institutional setting and awareness and communication. These are typical measures with significant energy saving potential with low funding implications ("low-hanging fruits") and eventually already secured donor funding, which are classified with a **high**

priority in the action plan.

- Medium term measures: the **medium priority** measures are expected to be implemented within a 4 to 7 years period equalling the **second implementation period of the action plan from 2014-2017**.
- Long term measures: the timeframe is considered to cover a period of more than 7 years. The implementation is more complex and thus less easily to be adopted, or depending on the existence of an institutional and policy setting. For the consideration in the action plan, they are assigned a **low priority** and thus are considered to be implemented not before the **third implementation period of the action plan between 2018 and 2020**.

For the purpose of the first NEEAP presented here, apart from the list of measures, **intermediate national energy savings targets** for the following periods of implementation have been proposed. These intermediate targets shall define realistic savings as a percentage of the baseline demand to be achieved in the relevant target year, consistent with the overall national indicative energy savings target referred to in chapter 2.2.

The targets set for this first action plan implementation period provide an indication only and have been determined based on experiences made (and published) in other countries. A more detailed analysis of potentials and corresponding energy savings requires an in-depth national review of economic sectors, to provide a better data base and solidify the assumptions made regarding the EE potentials.

Regular **monitoring and evaluation** of measures shall provide the Government and involved stakeholders with a clear view if the implementation is in line with the proposed time frame, if the intermediate energy savings targets are being achieved or if increased efforts are to be made to get back on the implementation path.

It is therefore foreseen that the Ministry of Energy and Natural Resources shall submit to the Government the following updated NEEAPs:

- a second NEEAP not later than 30 June 2014 (considering implementation status until end 2013),
- a third NEEAP not later than 30 June 2018 (considering implementation status until end 2017),
- and a fourth NEEAP not later than 30 June 2021 (considering implementation status until end 2020).

All NEEAPs shall describe the energy efficiency improvement measures planned and realised to reach the targets set out in chapter 2.2.

The following NEEAPs shall as well:

- include a thorough analysis and evaluation of the preceding NEEAP;

- include the final results with regard to the fulfilment of the energy savings targets set out in chapter 2.2;
- include plans for – and information on the anticipated effects of – additional measures which address any existing or expected shortfall vis-à-vis the target;
- use and gradually increase the use of efficiency indicators and benchmarks, both for the evaluation of past measures and estimated effects of planned future measures;
- be based on latest available data, supplemented with estimates.

2.2 Baseline energy consumption and calculation of the national EE target

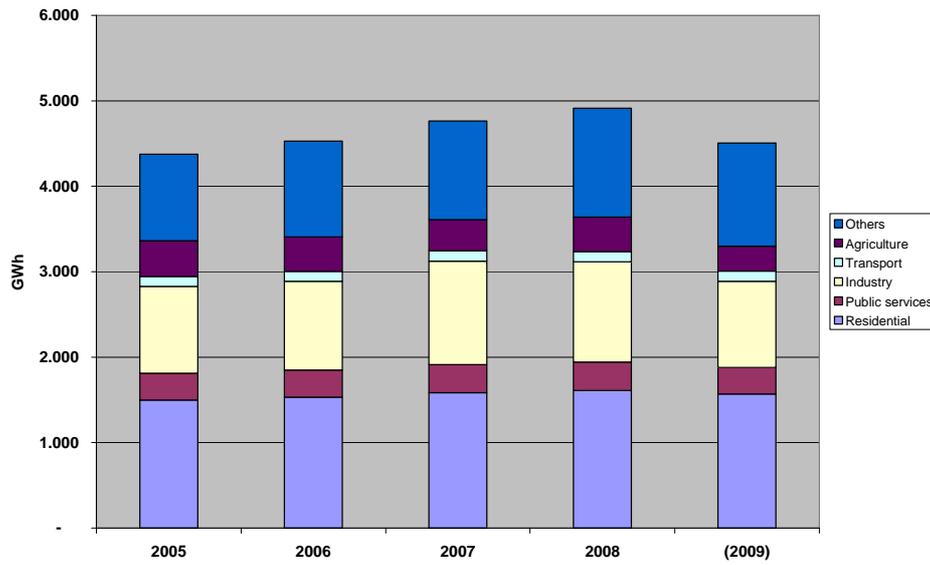
Armenia can meet only roughly one-third of its total demand of fuels, mainly natural gas and oil, through own resources, thus the country is highly dependant on imported energy sources. On the other hand it currently benefits from an electricity surplus produced from own hydro power plants, one nuclear power plant and several thermal power plants. From 2001 until 2008, the amount of electricity consumed grew steadily at about 6% p.a, which is less than the annual GDP growth average of 9-10% p.a. Other fuels used for residential heating, process heat, transportation and as fuel source for power plants have also steadily increased, in total about 7% p.a. between 2001 and 2008². The main fuel type is natural gas. In 2009, the preliminary figures show a decline due to general economic crisis of electricity demand by about 8% and of gas demand by almost 22%, compared to 2008.

The following charts provide an overview of the electricity consumption and gas consumption in the last 5 years (2005-2008, 2009 preliminary figures) that account for estimated 75% of the total energy demand³. For the other sources, no suitable data is available.

² source: *National Program on Energy Saving and Renewable Energy, Armenian Energy Institute*

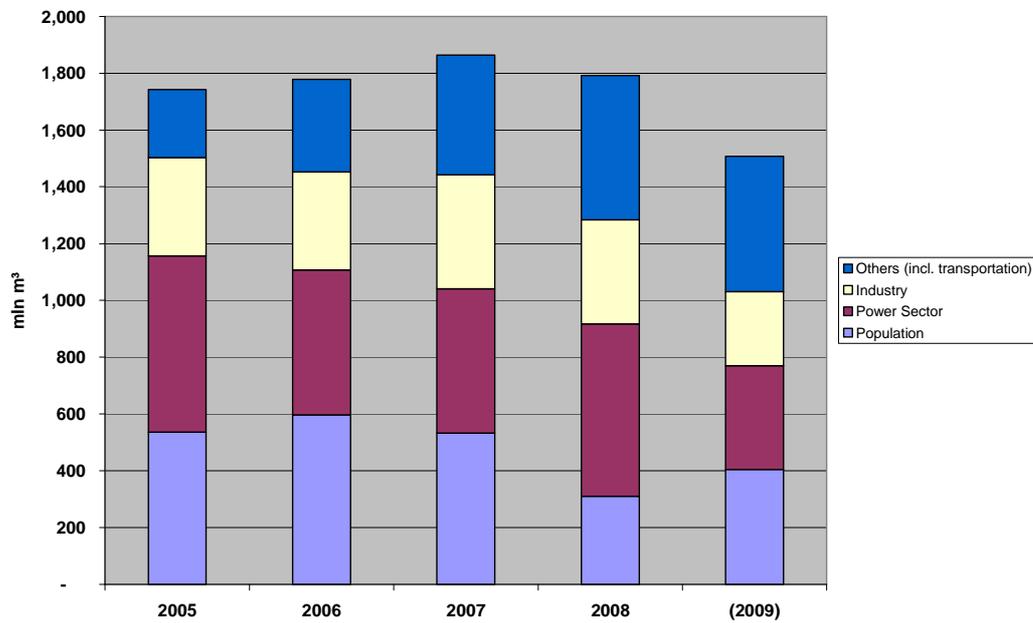
³ source: *2005 data provided in National Program on Energy Efficiency and Renewable Energy*

Chart 1: Electricity demand of main sectors 2005-2009 (prelim.)



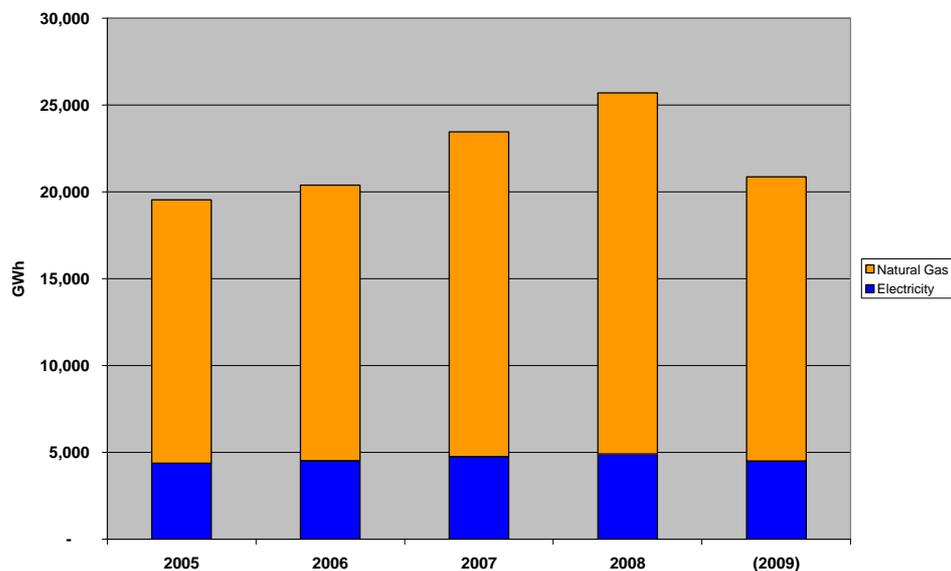
Source: Armenian Scientific Energy Institute

Chart 2: Natural gas demand of main sectors 2005-2009 (prelim.)



Source: Armenian Scientific Energy Institute

Chart 3: Total electricity and gas demand 2005-2009 (prelim.)



Source: Armenian Scientific Energy Institute

In the National Program on Energy Efficiency from 2007, the Armenian Scientific Energy Institute and the Energy Design Institute (Damare CJSC) provided an assessment of sectoral consumption data for the main user sectors (for 2001-2005).

However, what is missing since 1989, the last year when the energy balance was prepared, is a detailed annual energy supply and demand survey for all main sectors of economy that provides data on the annual final inland energy consumption of all energy users for the most recent years, including data on:

- energy supply (import, production, inventory changes)
- energy transformation (primary and secondary transformation processes)
- final energy demand of all relevant sectors
- useful energy demand according user categories (residential heating, industrial heat demand, stationary engines, lighting, air-conditioning, etc.)

Due to the missing basic data and with the information made available from different sources, it is at the moment not possible to draw a realistic baseline scenario that will provide a sound base to estimate absolute savings to be achieved in the target year.

Therefore, this first NEEAP provides only an indication of annual savings in relative terms (% p.a.) compared to the energy demand of the relevant sector (to be defined) where the proposed measures is part of.

As soon as detailed energy balances will become available, i.e. final energy demand per sector (in absolute terms), the second NEEAP (2014) will have to update this

information and provide relevant data on the calculation of the national energy saving target for the year 2020 as well as intermediate targets for the years 2013 and 2017, as proposed in the template provided in Annex 1.

The table below provides a summary of estimated energy efficiency savings that shall be reached by the implementation of measures proposed in the chapters 4 and 5.

As mentioned above, the savings reached by each year are indicative targets that are based on saving estimations in the National Program for Renewable Energy and Energy Savings for Armenia (mainly for industry and energy sector, transportation, water sector) and supported by reference to international studies and experience (mainly for building and service sectors⁴).

⁴ As for building refurbishment and corresponding energy saving potentials compare e.g. with the World Bank Study "Status of Energy Efficiency in Western Balkans" (2010). The study estimates the saving potential in residential buildings to be between 10 and 35% and in service sector 10 to 30%, and this for economies in transition similar to Armenia (e.g. Albania, Kosovo, Montenegro). Average quantitative savings have been regarded as a technical potential to be possibly realised in Armenia as well.

Table 2: Estimated annual savings per measures in % (2011-2020) compared to final energy consumption baseline

Sector/Measure	Baseline				Estimated annual savings per measure in % of the											Aggregated savings per measure				
	2008	2009	2010	average 2008-2010	annual/cumulated savings	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ			
	[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]	[in %]	[in %]												
I. Horizontal measures																	0,0%	n/a		
I.1	Implementation of a regular national "Energy Statistic" (with annual updates)																0,0%	n/a		
I.2	Implementation of a "National Energy Agency for Energy Efficiency and Renewable Energy"																0,0%	n/a		
I.3	Financial Support for Energy Efficiency measures in all sectors																0,0%	n/a		
I.4	Information campaigns, training and education in the area of energy efficiency improvements				n/a	n/a	n/a	n/a									0,0%	n/a		
I.5	General regulatory demand side measures																0,0%	n/a		
I.6	Assess the economic rationale of measures proposed in the NEEAP																0,0%	n/a		
I.7	Public Procurement for Energy Efficiency																0,0%	n/a		
II. Building sector					annual	0,0%	0,5%	0,8%	1,4%	1,8%	2,5%	3,0%	3,7%	4,5%	5,0%					
					cumulated	0,0%	0,5%	1,3%	2,7%	4,4%	6,9%	9,9%	13,5%	18,0%	23,0%	23,0%	n/a			
II.1	National Building Code considering energy performance of buildings					0,0%	0,3%	0,4%	0,5%	0,6%	0,7%	0,7%	0,8%	1,0%	1,0%	6,0%	n/a			
II.2	Standards and calculation methodology to assess energy performance in buildings					0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,9%	4,5%	n/a			
II.3	Institutional capacity-building for implementing and enforcing new standards					0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,8%	4,4%	n/a			
II.4	Establishing quality assurance/quality control (QA/QC) standards that will support the certification of key building materials for energy performance.					0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,8%	4,4%	n/a			
II.5	Set up road-test procedures for building certification and methodology for assessment of energy performance for pilot buildings				n/a	n/a	n/a	n/a	0,0%	0,0%	0,0%	0,1%	0,1%	0,2%	0,2%	0,3%	0,4%	0,4%	1,7%	n/a
II.6	Training and education in correspondance with the promotion of integrated building design approach and new energy performance requirements in buildings					0,0%	0,0%	0,0%	0,1%	0,2%	0,3%	0,3%	0,4%	0,4%	0,5%	2,1%	n/a			
II.7	Pilot Project: Design competition and construction of several "best-practice" buildings (e.g. school or other public building, and a multi-family house) in Yerevan and another larger city, using an integrated building design approach within available budget and time schedule for the construction of a typical building.					0,0%	0,0%	0,0%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,5%	n/a			
II.8	Development of an incentive scheme to promote energy efficient construction or reconstruction in residential and service buildings					0,0%	0,0%	0,0%	0,0%	0,0%	0,3%	0,5%	0,7%	1,0%	1,3%	3,8%	n/a			

Sector/Measure	Baseline				annual/ cumulated savings	Estimated annual savings per measure in % of the										Aggregated savings per measure	
	2008	2009	2010	average 2008-2010		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
	[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]
III. Public & Private Service Sector					annual	0,0%	0,2%	0,4%	1,1%	1,1%	1,5%	1,8%	2,3%	2,8%	3,4%		
					cumulated	0,0%	0,2%	0,6%	1,7%	2,8%	4,3%	6,1%	8,4%	11,2%	14,6%	14,6%	n/a
III.1 Information campaigns on several issues of energy efficiency to be applied in public and private service buildings	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,5%	0,5%	0,7%	0,9%	1,1%	1,3%	1,5%	6,5%	n/a
III.2 Efficient energy services in public facilities - investive measures	n/a	n/a	n/a	n/a		0,0%	0,2%	0,4%	0,6%	0,6%	0,7%	0,7%	0,8%	0,8%	1,0%	5,8%	n/a
III.3 Monitoring of energy consumption and achieved savings in service buildings	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,2%	0,4%	0,7%	0,9%	2,3%	n/a
IV. Industry sector					annual	0,3%	0,7%	1,1%	1,6%	2,0%	2,5%	3,1%	3,6%	4,0%	4,4%		
					cumulated	0,3%	1,0%	2,1%	3,7%	5,7%	8,2%	11,3%	14,9%	18,9%	23,3%	23,3%	n/a
IV.1 Considering energy efficiency aspects for the construction of new industrial facilities	n/a	n/a	n/a	n/a		0,0%	0,1%	0,2%	0,3%	0,5%	0,5%	0,8%	0,8%	1,0%	1,0%	5,2%	n/a
IV.2 Implementation of Energy Efficiency Financing Facility for Industrial Enterprises	n/a	n/a	n/a	n/a		0,0%	0,2%	0,4%	0,6%	0,6%	0,8%	0,8%	1,0%	1,0%	1,2%	6,6%	n/a
IV.3 Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	n/a	n/a	n/a	n/a		0,3%	0,4%	0,5%	0,7%	0,9%	1,2%	1,5%	1,8%	2,0%	2,2%	11,5%	n/a
V. Transport sector					annual	0,2%	0,9%	1,2%	1,7%	2,0%	2,3%	2,6%	2,9%	3,2%	3,4%		
					cumulated	0,2%	1,1%	2,3%	4,0%	5,9%	8,2%	10,8%	13,7%	16,9%	20,3%	20,3%	n/a
V.1 Vehicle Inspection and Maintenance (I&M) program	n/a	n/a	n/a	n/a		0,0%	0,5%	0,5%	0,8%	0,8%	0,9%	0,9%	1,0%	1,0%	1,0%	7,3%	n/a
V.2 Traffic Demand Management (TDM) scheme	n/a	n/a	n/a	n/a		0,0%	0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	3,6%	n/a
V.3 Dissemination of information on technologies and approaches for reducing energy consumption effectively	n/a	n/a	n/a	n/a		0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,9%	1,0%	5,5%	n/a
V.4 Continuous exchange of mini buses by larger passenger buses operated by natural gas	n/a	n/a	n/a	n/a		0,1%	0,2%	0,3%	0,3%	0,4%	0,4%	0,5%	0,5%	0,6%	0,6%	3,9%	n/a
VI. Agricultural sector					annual	0,2%	0,2%	0,3%	0,4%	0,4%	0,9%	1,4%	2,4%	3,4%	4,4%		
					cumulated	0,2%	0,4%	0,7%	1,1%	1,5%	2,4%	3,8%	6,2%	9,6%	14,0%	14,0%	n/a
VI.1 Utilization of gravity flow in irrigation systems and modernisation of existing pumping stations and upgrading secondary and tertiary canals	n/a	n/a	n/a	n/a		0,2%	0,2%	0,3%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	3,5%	n/a
VI.2 Optimization of drinking water pumping stations	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	1,0%	2,0%	3,0%	4,0%	10,5%	n/a
VII. Total	n/a	n/a	n/a	n/a												n/a	n/a

The proposed sectoral energy savings are based on potential assessments referred to by the author and have been adjusted to the target year. The summary effects to be possibly realised by the target year 2020 are shown in Table 3 and further explained in the following chapters 4 and 5.

Table 3: Estimated energy savings cumulated for each sector until 2020

Energy saving target adopted in 2020:		
Residential/Households	in %	23,0%
Industry & Energy sector	in %	23,3%
Transport	in %	20,3%
Public and commercial services	in %	14,6%
Water sector	in %	14,0%

Source: own calculation

The report on the “National Program on Energy Saving and Renewable Energy of Republic of Armenia” just comes up with potential energy savings of the main fuel sources, around 1,036 GWh for electricity (ca. 23 % of 2008 demand) and 573,000,000 m³ for natural gas (ca. 25% of 2008 demand). These savings are mainly dedicated to the industry and energy sectors, as well as transportation and water sector. References to the building sector (residential and public/private services) are not found to be too specific there.

3 Addressing Barriers for Energy Efficiency in Armenia

Armenia has taken important steps to encourage more efficient use of energy, but many more steps must still be taken. However, the potential is mainly untackled due to a number of reasons that can be summarized in a list of barriers to addressing energy efficiency:

- The legal framework needs to be implemented and enforced. Especially in the building sector the existing building code needs binding provisions regarding thermal quality of new and existing buildings and enforced standards and methodologies to assess energy performance in buildings.
- Creating awareness about energy efficiency needs a lot of information and know-how provided to all energy consumers (private, business, service sector, etc.). Yet, there is a weak institutional setting in Armenia of communicating energy efficiency with profound capacity, e.g. through a National Agency or NGOs.
- Private consumers (i.e. households) miss general and simple information on what can be done to reduce energy demand in the daily life, such as in housing, use of electric appliances, transportation etc.
- Many political decision-makers and private businesses still fail to see the value in energy efficiency investments, despite the successes of donor-sponsored pilot projects and programs, because of missing awareness, sufficient current energy supply and to a certain extent because they simply lack information on energy consumption for and energy potentials in the main sectors.
- The natural gas tariff encourages wasteful use by some smaller customers. There tariff structure does not provide an incentive for consumers to use less energy. Furthermore, there are no other financial incentives available that would encourage saving energy.

The action plan presented in the next chapters of this document will address these main barriers and provide a set of selected instruments and action to overcome the main legal, institutional, decision-making and information barriers.

4 Horizontal and cross-sectoral measures

4.1 Overview of horizontal and cross-sectoral EEI measures

Target:	Provide the necessary institutional setting and capacity to implement the Armenian Energy Efficiency Action Plan and ensure continuous evaluation and monitoring of activities
Target group:	Ministries / Agencies

Energy efficiency is not merely a matter of a single sector. Many measures are intertwined and mutually supportive. Energy efficiency measures affecting several or all energy consumption sectors are reflected within the horizontal activities. The main objective is to build up the necessary institutional capacities that will ensure an established structure for the implementation of the action plan.

The measures proposed are to focus on cross-sectoral issues for a wide range of user target groups:

- Legal aspects: integration of the NEEAP into existing energy policies (e.g. amending the Law on Energy Efficiency and Renewable Energy by taking the action plan as one main instrument for implementation into consideration); and the necessary reinforcement of the national energy statistic. The issue of public procurement of energy efficient equipment is mainly to provide public purchasers with technical specifications and the necessary “good will” to consider the acquisition of energy efficient products and services by spending public money.
- Institutional setting: installation of a National Energy Agency. The main responsibility for taking political action will stay with the Ministry of Energy and Natural Resources (legislation and policy making), while the new Agency will implement, co-ordinate implementation, evaluate and regularly report NEEAP and give also technical expertise to government in developing policies. The institutional building will also require additional personnel capacities within the responsible unit of the Ministry of Energy and Natural Resources (Division of energy efficiency) and special training should be provided for new employees in international energy efficiency practices and strategies (training financed by R2E2 and UNDP/GEF, employees salaries from state budget).
- Awareness, information campaigns and technical assistance/training on energy topics shall be enforced. It is a measures which is very long-lasting and needs to be reinforced all the time (through specific campaigns and built-up of proper material and media)

The described horizontal and cross-sectoral measures will factually not create any energy saving per se, but will be the main driver for achieving savings under the following sectoral measures described in chapter 5. However, relevant indicators for monitoring the outcome are being defined with the measures presented in Table 4.

Table 4: List of horizontal and cross-sectoral measures under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
I.1	Implementation of a regular national "Energy Statistic" (with annual updates)	<p>Since 1989, there is no regular energy balance produced for Armenia. A government decree was approved in 2007 to prepare a national energy balance sheet, yet however, the decree has not been implemented.</p> <p>Necessary actions:</p> <ul style="list-style-type: none"> o Build-up of personal capacities at the National Statistics Office o Technical assistance and training of dedicated staff to implement energy statistics according to international standards and methods (e.g. compliance with IEA) o Performance of sectoral surveys and analysis (households, industry, service sector, etc.), including survey of changes over the years o requirement of large consumers (e.g. industry) to submit regular data on energy consumption o Regular update (i.e. annually) and publication o Elaboration of a energy balance "baseline" year (e.g. 2010) that will reflect the new methodology and provide detailed energy supply and consumption ectoral data and will serve as a basis for evaluating progress of EEAP in the future 	Ministry of Energy National Statistics Office	State budget EU-Inogate Programme (Technical Assistance) World Bank (GEF Grant)	2010 - 2011	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
I.2	Implementation of a "National Energy Agency for Energy Efficiency and Renewable Energy"	<p>It is necessary to embed the EEAP into a institutional setting for co-ordination and monitoring of progress made. The government is therefore to give a clear mandate, qualified staff and budgetary means to a national institution or agency to conduct the following main tasks:</p> <ul style="list-style-type: none"> o Co-ordinate and manage the activities to be implemented under the Armenian EEAP o Regularly evaluate progress of measures implemented under the EEAP against defined baseline consumption o Prepare regular reports and monitoring of EEAP activities (e.g. every 2-3 years) <p>Furthermore, it shall be ensured that the following activities shall be co-ordinated by the new entity or other responsible governmental agency(ies):</p> <ul style="list-style-type: none"> o developing short-term and long-term energy efficiency programs; o coordinating the energy efficiency activities in different branches of economy; o conducting information campaigns o developing energy efficiency standards o conducting certification and labelling; o certifying and/or licensing energy auditors; 	Ministry of Energy	World Bank (GEF Grant)	2010 - 2013	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
I.3	Financial Support for Energy Efficiency measures in all sectors	<p>Due to a primary lack of funding means provided by the national budget, it is a key task to provide properly adapted complementary funding of energy efficiency measures through providing primarily (in the short term) donor funding to financially support the planning and realisation of energy efficiency measures. This could be done through the following mechanisms:</p> <ul style="list-style-type: none"> o investing into energy efficiency measures in public facilities (schools, kindergartens, hospitals, street lighting, etc.) o grants for capacity-building/training activities for public administration to implement energy policies and strategies o On-lending programmes industry and SME, such as EBRD's Sustainable Energy Financing Facility. <p>In the medium to long-term, alternative sources (others than donor programmes), such as private sponsoring or public-private partnerships are to be sought to:</p> <ul style="list-style-type: none"> o realise in particular flagship energy efficiency projects in industry, public & private services or residential buildings. o support the development of energy services companies (e.g. ESCOs) - pilot activities and training programmes 	Ministry of Energy	Provision of credit lines and grant programmes from international financing institutions (UN, World Bank, EBRD, IMF, KfW, etc.) and development assistance (e.g. EU, USAID, bilateral programmes)	2010-2013	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
I.4	Information campaigns, training and education in the area of energy efficiency improvements	<p>Organising and running information campaigns and educational projects on energy efficiency and financial support for actions relating to the promotion of energy efficiency. The campaigns need to be time-specific and targeted to different kind of energy consumers (residential, service sector, industry, etc.). Proper indicators for measuring the effectiveness of awareness raising measures shall be developed when designing awareness campaigns.</p> <ul style="list-style-type: none"> ○ Use of energy efficient products. Campaigns will be targeted towards encouraging specific actions, e.g. residential buildings: optimising new construction (thermal requirements, integrated building design, use of optimised equipment for lighting, household appliances, heating-systems incl. pumps etc.) or ways to improve existing buildings cost-effectively ○ Information and education actions aimed at changing consumer behaviour and increasing social acceptance of solutions that improve energy efficiency in households, tertiary sector and industry. ○ Encourage providers and consumers to pay more attention to energy efficiency labelling and to the energy consumption of products bought and sold. ○ Training for sales staff as regards energy efficiency labelling and product life cycle costs. ○ Creation of a training system for energy efficiency specialists within tertiary education, as part of various disciplines. ○ Introduction of energy efficiency subjects into education programmes at all levels. 	Ministry of Energy (later: National Energy Agency)	State budget International donors (e.g. UNDP/GEF, World Bank) Private sponsorship	2010-2020 ongoing process	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
I.5	General regulatory demand side measures	<ul style="list-style-type: none"> o Providing incentives to energy consumers to use energy more efficiently and at real market costs. o Introduce load management tools and revise gas and electricity tariff structure based on detailed cost-benefit analysis. 	Ministry of Energy, Public Service Regulatory Commission	State budget, World Bank/ESMAP	2010-2012	High
I.6	Assessment of the economic rationale of measures proposed in the NEEAP	Adopt a methodology for assessment of economic viability of proposed energy efficiency programmes and measures	Ministry of Economy	State budget	2010-2012	High
I.7	Public Procurement for Energy Efficiency	<p>Public procurement contracts must include energy efficiency aspects when buying products, services or works. Specific criteria for public authorities and contracting parties need to be prepared, such as technical specifications and evaluation criteria for the purchase of public goods, works and services in all sectors, e.g. in the fields of:</p> <ul style="list-style-type: none"> o (re)construction of buildings o lighting o ICT and office equipment o air-conditioning and cooling o household appliances (e.g. refrigerators, washing-machines, coffee-machines) o vehicles <p>At the same time it should be ensured that the annual planning of public budgets - especially when taking into consideration necessary investments into infrastructure - construction, purchase of equipment, etc. - should consider energy efficiency aspects already in the budgeting phase.</p>	Public Procurement Agency (under Government) Ministry of Energy, Ministry of Finance, Ministry of Urban Development	Relies to purchase of goods, works and services made from state/municipal budget	2012-2015	Medium

5 Sectoral presentation and assessment of energy efficiency improvement programmes, energy services, and other measures to improve energy efficiency

5.1 Energy efficiency improvement measures in the residential building sector⁵

Overall Target:	Improved use of energy for heating and cooling while ensuring thermal comfort, and reduction of specific energy consumption in the preparation of hot water; implementation of the necessary legal and institutional framework; provision of large-scale information and awareness raising campaigns amongst all stakeholders
Target group:	Owners, tenants and operators of private homes (family houses, multi-family buildings), architects, planners, construction companies, legislative bodies

5.1.1 General introduction on the building sector

Almost all the Armenian housing stock has been constructed during Soviet period some 35-60 years ago without any regard to energy efficiency. Many of these buildings are now in obsolete condition and do not provide for minimum hygienic and comfort living conditions. Specific energy use per square meter is almost 3-5 times higher than in EU and varies between 320 and 690 kWh/m² per year. Nevertheless, in many households, the amount of space heated is limited to one or two rooms, as tenants have limited available household budget to cover the high energy costs.

Also, construction works in Armenia are presently performed more or less according to former Soviet practices and norms that almost do not involve buildings' energy performance and improvement issues. Such designs and construction works result in excessive energy consumption and growing amount of GHG emissions.

Currently, residential (and also public) buildings in the country are of low thermal-technical performance resulting in growing demand for and consumption of thermal energy. Buildings' low thermal technical performance reflects insufficient heat conduction resistance of building envelope and unnecessary expansion of glass cover. Besides, state supervision of mandatory implementation of current norms is absent. Armenia has voted for Intergovernmental construction norm MSN 2.04-02-2004 "Thermal Insulation of the Buildings," developed by Intergovernmental Normative-Technical Commission on Standards and Certification in Building Sector of CIS, however it has not been adopted and applied in Armenia.

⁵ 80% of the total building stock in Armenia is for residential purposes. So there is a specific focus to be given to the housing sector, nevertheless several measures presented here also reflect the need to be covered in other building types, mainly from the public and private service sector

According to preliminary research, via efficient thermal insulation of residential and public buildings, it is possible to reduce energy consumption for heating at least by 20-40%⁶, taking into consideration the low heating level in residential buildings. Of course, the technical potential for improving the building sector is much higher, and able to reach a minimum of 70% (and up to 90%).

New housing stock is largely privately owned and often built with limited financial means, leading to the use of inadequate building materials. It is therefore recommended to put an emphasis on low- and no-costs energy efficiency measures to overcome the lack of finance, while strengthening enforcement of the new building regulations.

Used building materials are rarely certified or labelled for thermal quality, while imported materials and components lack labels or are labelled in an inconsistent manner. There is some potential for developing domestic materials, and a domestic production of quality construction materials could be developed through the use of licenses for foreign components. However, this would require substantial investments in plants capacity, technology adaptation, training and marketing that seem to be premature at this stage, given limited market size. Such investments would only be viable when the standards enforcement capacities are in place, and when a real demand is effective on the market.

Since 2004, Armenia is involved in the European Neighbourhood Policy (ENP). The implementation of ENP action plan was approved in 2006 and is to contribute to harmonization of Armenian legislation, norms and standards with EU criteria. In this regard, improvement of energy efficiency of buildings and constructions also needs paying attention to EU directives.

According to EU Directive on “Energy Performance of Buildings”, cap values of energy consumption in buildings, buildings’ efficiency rankings, specific consumption of thermal energy for heating etc. Should be identified upon discretion of each country based on climatic conditions, technical and demographic data.

At the same time, improvement of buildings’ energy efficiency level is reflected in certain provisions of the Armenian “Law on Energy Saving and Renewable Energy” and of the “National Program on Energy Saving and Renewable Energy”. In this context, the Ministry of Energy and Natural Resources and Ministry of Urban Development in cooperation with the “Armenia – Improving the Energy Efficiency of Municipal Heating and Hot Water Supply” UNDP/GEF project, initiated a harmonization process of standards relevant to the sector. The Project’s work plan for 2009-2010 includes harmonization issues to international and European standards.

⁶ Sources: *Towards Energy Efficiency Buildings in Europe (2004)*

5.1.2 Overview of sector-specific measures

Summarizing one can say that apart from climate, the energy consumption in the building sector is significantly affected by the thermal-technical properties of buildings, the efficiency of heating and cooling systems, their regular inspection, maintenance and the behaviour of residents. This fact not only refers to residential buildings, but the same is true for public and private service buildings.

The main barriers in the building sector can be therefore defined as follows:

- lack of available energy statistics and qualitative data on energy demand in the sector,
- appropriate legislation (codes, standards, norms) and its enforcement to induce energy efficient (re)construction,
- coherent strategy for building sector development and plans for new constructions and renovation of existing buildings,
- availability of funds to support EE investments (e.g. availability of a financing scheme to support reconstruction and/or refurbishment of residential buildings),
- as well as knowledge and willingness of house owners, planners, architects and operators of buildings to improve the quality of buildings and support residents in adopting energy efficiency user practices;

Therefore, the main target for the developing measures in the residential building sector can be specified as follows:

- upgrading existing legislation and all by-laws (standards, norms) to reflect the necessary efforts to be made in increasing the energy of buildings,
- setting up educational programmes (tertiary education, on-the-job-training) to train students and employees of companies in the planning/design and construction sector to comply with new integrated design and building standards,
- establish necessary capacities on the enforcement level,
- develop pilot projects to demonstrate building best-practice (for rehabilitation and new buildings) and
- provide further incentives to promote energy efficient construction at all levels, such as introduction of energy passports or building operational costs to be used for advertising those flats and houses for sale/rent adhering to high energy efficiency standards (provide incentives for construction companies to enforce EE construction practices).

A broad range of measures proposed for existing and new buildings will account for **approx. 23% of total energy savings of the building sector** projected under the Armenian NEEAP by 2020.

The % savings attributed to each kind of measures is being demonstrated in Table 5. Marked red are the relevant intermediate energy saving target years, according to

which the following energy savings are foreseen:

- 2013: 1.3%
- 2017: 9.9%
- 2020: 23.0%

Table 6 provides a more detailed description of the measures of the building sector.

Table 5: Estimated savings per measure in the residential building sector from 2011-2020

Sector/Measure		Baseline				annual/ cumulated savings	Estimated annual savings per measure in % of the										Aggregated savings per measure	
		2008	2009	2010	average 2008-2010		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
		[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]
II.	Building sector					annual	0,0%	0,5%	0,8%	1,4%	1,8%	2,5%	3,0%	3,7%	4,5%	5,0%		
						cumulated	0,0%	0,5%	1,3%	2,7%	4,4%	6,9%	9,9%	13,5%	18,0%	23,0%	23,0%	n/a
II.1	National Building Code considering energy performance of buildings						0,0%	0,3%	0,4%	0,5%	0,6%	0,7%	0,7%	0,8%	1,0%	1,0%	6,0%	n/a
II.2	Standards and calculation methodology to assess energy performance in buildings						0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,9%	4,5%	n/a
II.3	Institutional capacity-building for implementing and enforcing new standards						0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,8%	4,4%	n/a
II.4	Establishing quality assurance/quality control (QA/QC) standards that will support the certification of key building materials for energy performance.						0,0%	0,0%	0,0%	0,1%	0,1%	0,2%	0,2%	0,3%	0,4%	0,4%	1,7%	n/a
II.5	Set up road-test procedures for building certification and methodology for assessment of energy performance for pilot buildings	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,1%	0,2%	0,3%	0,3%	0,4%	0,4%	0,5%	2,1%	n/a
II.6	Training and education in correspondance with the promotion of integrated building design approach and new energy performance requirements in buildings						0,0%	0,0%	0,0%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,5%	n/a
II.7	Pilot Project: Design competition and construction of several "best-practice" buildings (e.g. school or other public building, and a multi-family house) in Yerevan and another larger city, using an integrated building design approach within available budget and time schedule for the construction of a typical building.						0,0%	0,0%	0,0%	0,0%	0,0%	0,3%	0,5%	0,7%	1,0%	1,3%	3,8%	n/a
II.8	Development of an incentive scheme to promote energy efficient construction or reconstruction in residential and service buildings						0,0%	0,0%	0,0%	0,0%	0,0%	0,3%	0,5%	0,7%	1,0%	1,3%	3,8%	n/a

Table 6: List of measures in the residential building sector specified under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
II.1	National Building Code considering energy performance of buildings	Adoption of a National Building code considering energy performance of buildings (compatible with international best practices, such as the European Energy Performance Building Directive) with regular revisions of the building code (e.g. all 3 years). The new code will consider the total building energy performance (including heating, hot water, air conditioning and ventilation) and set specific targets concerning the maximum energy demand of buildings. Construction permits are to be issued taking into consideration that all requirements	Ministry of Energy, Ministry of Economy, Ministry of Urban Development	UNDP/GEF	2010 - 2012	High
II.2	Standards and calculation methodology to assess energy performance in buildings	Elaborate and adopt national calculation methodology to determine building energy consumption based on standardized use and establish minimal requirements for thermal properties of a building, heating and air-conditioning systems, application of renewable energy sources and relevant design aspects of buildings (e.g. inclusion of passive solar elements).	Ministry of Energy, Ministry of Economy, Ministry of Urban Development	UNDP/GEF	2010 - 2012	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
II.3	Institutional capacity-building for implementing and enforcing new standards	Develop responsibilities and clear procedures within the responsible Ministry of Urban Development to address the enforcement of the new building energy efficiency codes and standards. Train staff to ensure compliance with the new code throughout design, construction and maintenance phases, through capacity building in energy audits: Define procedures and methodology for issuance of building energy passports and the types of buildings for which the passports will become compulsory.	Ministry of Urban Development	UNDP/GEF	2010 - 2012	High
II.4	Establishing quality assurance/quality control (QA/QC) standards that will support the certification of key building materials for energy performance.	Establish a mandatory testing system for the conformity of construction materials with building energy performance according to national standards. Establish performance requirements for materials produced locally or imported, which will allow builders and designers to make better informed decisions about the performance of the construction materials used in new buildings. Introduce a voluntary certification and labelling scheme for construction materials (e.g. windows, insulation, boilers, etc.) to provide incentives for high-quality materials to enter the Armenian market. Furthermore, national norms for QA/QC shall be established in manufacturing facilities and assistance for suppliers to comply with energy-efficiency related national standards	Ministry of Urban Development, Ministry of Economy	UNDP/GEF	2010 - 2012	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
II.5	Set up road-test procedures for building certification and methodology for assessment of energy performance for pilot buildings	Set up road-test procedures for building certification and methodology for assessment of energy performance for several pilot buildings (e.g. schools, residential buildings) to be constructed following integrated building design approach. Use experiences and outcomes from relevant projects, such as UNDP/GEF Project on "Improving the Energy Efficiency of Municipal Heating and Hot Water Supply" (UNDP/GEF/00035799)	Ministry of Urban Development	UNDP/GEF	2012 - 2014	Medium

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
II.6	Training and education in correspondance with the promotion of integrated building design approach and new energy performance requirements in buildings	Promotion of best energy design and construction practices in the construction sector: (1) Develop and introduce module on energy efficient building design in the curricula of University for Architecture and Construction and provide training assistance and other support materials (Teachers' Guide) for teaching staff; (2) Design and deliver training courses for staff in the field of building energy performance, solar architecture and applications for renewable energy sources in buildings; (3) Provide training courses for practicing architects and engineers concerning the application of the new codes and calculation methodologies; (4) Raise awareness of building constructors on economic, environment and social benefits of integrated building design and on locally available and tested technologies, materials and other EE applications in buildings (e.g. through public events at major construction events); (5) Organize information campaign for the general public promoting benefits of the new building code and the Energy Passport; (6) promote results of pilot buildings and integrated building design regularly through the national media;	Ministry of Education and Science	State budget Intl. donors	2010-2020	Medium

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
II.7	Pilot Project: Design competition and construction of several “best practice” buildings (e.g. school or other public building, and a multi-family house) in Yerevan and another larger city, using an integrated building design approach within available budget and time schedule for the construction of a typical building.	Pilot project should cover the following: (1) low- or no-cost measures; (2) monitor energy performance of pilot buildings; (3) Adopt a new standard design for newly constructed buildings (e.g. schools) based on the ones applied in the pilot buildings; (5) introduce integrated energy efficient design methodology in all planned public construction (technical specifications for public procurement);	Ministry of Urban Development, Ministry of Education, Ministry of Finance, Technical Assistance from Donors	UNDP/GEF	2012 - 2015	Medium
II.8	Development of an incentive scheme to promote energy efficient construction or reconstruction in residential and service buildings	Development of an incentive scheme for energy efficient construction or reconstruction. Provide appropriate and financially sound support mechanisms that would allow the building owners to comply with enhanced standards and simultaneously accept the opportunity to invest into cost-effective energy efficiency measures by realising visible benefits (e.g. small scale subsidy and financing schemes, support for energy passport)	Ministry of Energy, Ministry of Finance, with international donors and national banks	State budget Intl. donors	2012 - 2015	Low

5.2 Energy efficiency improvement measures in the public and private service sector

Target:	Reduction, or minimisation of energy consumption in public and private service sector focusing on a various range of applications in buildings and public space (e.g. street-lighting, use of office equipment, air-conditioning)
Target group:	Public administration (ministries, towns/municipalities), public lighting operators, private office owners and tenants, employees in these companies

5.2.1 General introduction on the public and private service sector

The Armenian economy is agricultural-industrial oriented, with a developing service sector. The structure of 2004 GDP in Armenia is: 40% in industrial sector, 35% in service sector (including construction and transportation), and 25% in agriculture. The share of service sector is 1.5-2 times lower than in developed countries (50-70%).

The energy intensity index in the service sector of Armenia, 90.4 kg oe/\$1,000 USD is close to that of many developed and developing countries: Estonia, 91 kg oe/\$1,000 USD, Latvia, 99.7 kg oe/\$1,000 USD, Czech Republic, 114.8 kg oe/\$1,000 USD (see Figure 1). According to the “National Program on Energy Saving and Renewable Energy of Republic of Armenia” paper (2007), the service sector in Armenia is experiencing the same issues of energy efficiency as in developed countries and in general does not represent a high absolute energy saving potential.

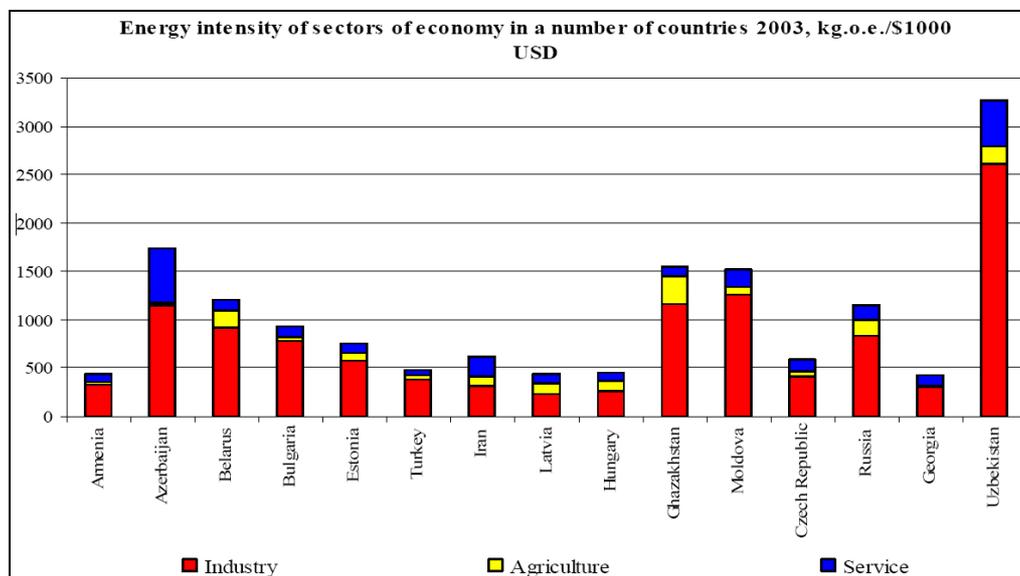


Figure 1: Energy intensity of economy in a number of countries in 2003, kg oe/thous.USD

Source: Scientific Research Institute of Energy for the Alliance to Save Energy/USAID: “National Program on Energy Saving and Renewable Energy of Republic of Armenia”; Yerevan 2007 as by Key World Energy Statistics from IEA: <http://www.iea.org/dbtw-wpd/Textbase/stats/nmcbalancetable.asp>

Nevertheless, the role of the public administration in providing good practice and thus being a shining example for the other sectors is evident. Public spending is a significant contributor to the countries' GDP. The state administration, all regional and local authorities and other public institutions (e.g. health sector, schools) regularly purchase energy consuming devices, such as office equipment, lighting, diverse household appliances (fridges, dishwashers, washing-machines, etc.) and other equipment used for air-conditioning, ventilation, etc.

It is therefore of importance to provide the public sector with a clear strategy, i.e. to demand energy efficient applications and equipment and directing public spending towards higher-quality products. Energy efficient public procurement will provide cost-effective means to improve the energy intensity of the sector as slightly higher purchasing costs will pay back within a couple of years. On the other hand the availability of energy efficient products on the market will steadily increase, if the demand is rising.

Pretty the same issues are to be addressed to the private service sector, although it is generally a very inhomogeneous market segment which usually is not subject to direct influence by the government. The issue for this sector is therefore to increase the awareness of the protagonists in this area – business owners, service companies, operators of office space and commercial trading, etc. – and provide them with a scope of measures that would foster concrete action towards energy efficiency. Although most of the energy used in service buildings is spent for heating and hot water (measures already covered in chapter 5.1), the growing demand for ventilation and cooling in these buildings is a serious issue to be addressed in the countries energy policy.

5.2.2 Overview of sector-specific measures

The operation of public buildings is a relevant cost factor in the public sector due to the share of energy costs in the total budget. Apart from lighting, heating and cooling of buildings and use of various equipment (ICT, office equipment, household appliances used in offices etc.) are the most significant consumers in service buildings. Together with the improvement of the energy efficiency of mentioned equipment, efficient user behaviour constitutes for a large saving potential (from 20% to 60%, depending on the baseline consumption) in this area. The general energy efficiency measures covering the building envelope are already specified in chapter 5.1 (also valid for service buildings).

In addition to the energy consumption in public buildings, operation of lighting in public buildings and public street-lighting in towns and municipalities make a relevant contribution to the final energy consumption in the public sector. Street-lighting projects are usually financed out of municipal budgets. The current practice is that in case of efficiency measures implemented (leading to savings in operational costs covered by the municipal budget) the local authority is not able to dispose of the energy cost

savings, as operational budgets in this case will be usually cut by the central government. So there is no real incentive to realise efficiency measures. Finding ways to change this situation (e.g. financing schemes, such as energy performance contracting) will definitely increase the interest in becoming more energy conscious.

As for street-lighting, the largest consumer in this area is the City of Yerevan, in other towns and municipalities the issue of street-lighting is of less importance, mainly due to absence of fully operated lighting-systems. Lighting is, to a large extent, being consumed inefficiently, which results from the use of obsolete light sources, unreliable regulation (switching, declining power supply voltage) and wrong positioning and location of light sources. Upgrading of public lighting will focus on the installation of modern highly efficient light sources for public lighting as well and reliable and efficient regulation and management of operation.

The three measures proposed for the service sector can save up to **approx. 15% of total energy savings of sector** by 2020. However, as shown below, the effects are low in the short-term and will grow steadily with increasing the penetration of efficiency measures in the service sector.

The % savings attributed to each kind of measures is being demonstrated in Table 7. The relevant intermediate energy saving target years, according to which the following energy savings are foreseen, are:

- 2013: 0.6%
- 2017: 6.1%
- 2020: 14.6%

Table 8 provides a more detailed description of the measures of the building sector.

Table 7: Estimated savings per measure in the public and private service sector from 2011-2020

Sector/Measure		Baseline				annual/ cumulated savings	Estimated annual savings per measure in % of the										Aggregated savings per measure	
		2008	2009	2010	average 2008-2010		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
		[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]
III.	Public & Private Service Sector					annual	0,0%	0,2%	0,4%	1,1%	1,1%	1,5%	1,8%	2,3%	2,8%	3,4%		
						cumulated	0,0%	0,2%	0,6%	1,7%	2,8%	4,3%	6,1%	8,4%	11,2%	14,6%	14,6%	n/a
III.1	Information campaigns on several issues of energy efficiency to be applied in public and private service buildings	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,5%	0,5%	0,7%	0,9%	1,1%	1,3%	1,5%	6,5%	n/a
III.2	Efficient energy services in public facilities - investive measures						0,0%	0,2%	0,4%	0,6%	0,6%	0,7%	0,7%	0,8%	0,8%	1,0%	5,8%	n/a
III.3	Monitoring of energy consumption and achieved savings in service buildings						0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,2%	0,4%	0,7%	0,9%	2,3%	n/a

Table 8: List of measures in the public and private service sector specified under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
III.1	Information campaigns on several issues of energy efficiency to be applied in public and private service buildings	Office equipment and room ventilation and conditioning systems used in service buildings provide usually a great potential for energy efficiency through changing of user behaviour and optimising existing systems through energy efficient operation. The result are significant savings on the operation costs and higher user comfort. The advantages and types of measures to be adopted to optimise existing facilities and systems shall be transmitted through public information campaigns specifically addressing the following issues: - operating lighting in offices efficiently - use of office equipment (computers, printers, copiers, servers, etc.) - air-conditioning and ventilation - other household appliances used in offices (e.g. refrigerators, cookers, etc.) - availability of energy efficiency labels and how they can be used for purchasing decisions - evaluation of the potential of behaviour change impact and provision of corresponding recommendations to the public building administration	Ministry of Energy, National Energy Agency	World Bank / GEF	2010 – 2020 (continuous activity)	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
III.2	Efficient energy services in public facilities - investive measures	Defining minimum requirements for provision of energy efficient services in public facilities, and implementation of correlating investive measures reducing the energy demand of public (and private) service buildings (heating, air-conditioning, use of office equipment) and optimisation of public lighting systems (e.g. learning from experiences made in City of Yerevan); Provide examples of financing such projects through ESCOs.	Ministry of Energy Public and private service facilities' operators	World Bank	2011 - 2013	High
III.3	Monitoring of energy consumption and achieved savings in service buildings	"Energy accounting" or regular monitoring of energy consumption in public buildings is an important aspect to improve the consciousness regarding energy use. Many building operators however do not know about their building energy consumption and energy costs accrued. The idea is to support the introduction of building energy accounting to monitor energy consumption and savings in case of rehabilitations.	National Energy Agency	Building owners	2018 - 2020	Low

5.3 ***Energy efficiency improvement measures in industry sectors (including energy production)***

Target:	Reduction of energy intensity with respect to value-added production in the industry and the energy sector (energy production, transmission and distribution companies); optimisation of energy supply in the country's power plants and distribution network
Target group:	Stakeholders in industrial production and energy utilities

5.3.1 ***General introduction on the industry & energy sectors***

Industrial activities:

The 40% share of industry in the GDP (2004) of Armenia is close to the one in developed countries (30-40%).

The industry sector of Armenia has, as compared to other sectors, also a low energy intensity characteristic, 329.4 kg oe/\$1,000 USD, compared to the one for Uzbekistan, 2616 kg oe/\$1,000 USD, Estonia, 569 kg oe/\$1,000 USD, Moldova, 1264 kg oe/\$1,000 USD, and Georgia, 304 kg oe/\$1,000 USD (see Figure 1).

This means that the spectrum of the energy intensive production in the country is very low (e.g. "Nairit" factory, "Polyvinylacetate" factory use mainly electricity, and cement, ore and mining industry is mainly depending on oil and natural gas), and that the share of production using modern energy efficient technologies is fairly high (food production, non-energy intensive production).

Nevertheless, it is necessary to make use of energy efficient technologies and production methods which make it possible to reduce energy intensity of the production in the main energy consuming industrial sectors (such as chemical industry, metallurgy), but also within the larger sector smaller and medium-sized companies.

Energy production:

Armenia has no oil and natural gas reserves, and imports all its fossil fuel demand. Electricity is provided by:

- A nuclear power plant which provides 30-40%;
- Hydroelectric plants satisfy 20-35% of the country's needs. Besides, the hydropower generation is declining due to limitations associated with irrigation purposes of the hydro plants;
- The remaining electricity demand is satisfied by thermal power plants which can burn either oil or natural gas. The share of the thermal plants in the generation mix of the country is on average 30-35%.

In the heating sector, due to the consequences of the economic and

energy crisis that followed the separation of Armenia and its neighboring countries from the former Soviet Union in 1990, the municipal heat and hot water supply systems in all Armenian cities essentially collapsed. While in some cities the operations of the former, centralized district heating (DH) system have been partially restored, the vast majority of the urban population still lacks organized heat and hot water supply services. Nowadays, in larger public and private service buildings there is often a centralised boiler house existing, while in residential buildings local heating systems prevail. Many of these centralised boiler houses are operated inefficiently or are generally old. They would need a focus within the Action Plan to undergo major refurbishment or reconstruction.

5.3.2 Overview of sector-specific measures

The measures to improve energy efficiency in the industry sector must be particularly targeted at energy demand, monitoring and management in the individual technological processes, introduction of innovative approaches primarily aimed at reducing the energy intensity of industrial production, and investments in energy efficiency in the selected industrial branches. Generally, there is a lack of awareness and knowledge on potential EE measures as well as incentives to implement them. In order for these measures to be effective, a change must occur in people's mentalities and behaviour. The National Program on Energy Saving and Renewable Energy has assessed a series of measures throughout the specific sectors, which need to be tackled.

Reference is therefore made to the existing potential analyses and studies, one of which was also prepared by the International Finance Co-operation (IFC), that is helping Armenian financial institutions develop sustainable energy finance products, thereby increasing renewable energy generation and lowering electricity waste and greenhouse-gas emissions. Another of these sustainable energy financing institutions ("ArmSEFF" programme, see Annex 3: List of relevant donor projects and programs ongoing and of past) is being developed by the EBRD (envisaged start: autumn 2010).

A focus is also to be given to the power and gas sector. Obsolete and old infrastructure, a high share of production and transmission losses are putting a pressure on the utilities to maintain their systems reliable and make them fit for the future – which is showing sharp increases of energy demand (up to 10% p.a. until 2020, once the "economic crisis" is over). Although there are several programs running with support from e.g. the World Bank, continuous improvement and maintenance of existing energy production and distribution facilities remains a high priority for ensuring a sustainable and reliable energy system. Together with the improvement of the infrastructure, measures to ensure the affordability of gas and electricity tariffs (as described as an improvement measure in chapter 4) have to be enforced.

A summary of the critical measures proposed can be found in

Table 10. The table is split into demand side measures on the one hand (i.e. efficiency measures at industrial users) and on the other hand on measures focussing on the supply side (looking for improvements in the supply and distribution of heat and electricity through utilities).

The targeted savings to be reached by 2020 are significant and could reach **approx. 42% of total energy savings of the industry (and energy production) sector.**

The % savings are also given in Table 9. The relevant intermediate energy saving targets are as follows:

- 2013: 2.1%
- 2017: 11.3%
- 2020: 23.3%

Table 9: Estimated savings per measure in the industrial sector from 2011-2020

Sector/Measure		Baseline				Estimated annual savings per measure in % of the											Aggregated savings per measure	
		2008	2009	2010	average	annual/ cumulated	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
		[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]											
IV.	Industry sector					annual	0,3%	0,7%	1,1%	1,6%	2,0%	2,5%	3,1%	3,6%	4,0%	4,4%		
						cumulated	0,3%	1,0%	2,1%	3,7%	5,7%	8,2%	11,3%	14,9%	18,9%	23,3%	23,3%	n/a
IV.1	Considering energy efficiency aspects for the construction of new industrial facilities	n/a	n/a	n/a	n/a		0,0%	0,1%	0,2%	0,3%	0,5%	0,5%	0,8%	0,8%	1,0%	1,0%	5,2%	n/a
IV.2	Implementation of Energy Efficiency Financing Facility for Industrial Enterprises	n/a	n/a	n/a	n/a		0,0%	0,2%	0,4%	0,6%	0,6%	0,8%	0,8%	1,0%	1,0%	1,2%	6,6%	n/a
IV.3	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers						0,3%	0,4%	0,5%	0,7%	0,9%	1,2%	1,5%	1,8%	2,0%	2,2%	11,5%	n/a

Table 10: List of measures in the industrial sector specified under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding Source	Duration	Priority
Demand side measures						
IV.1	Considering energy efficiency aspects for the construction of new industrial facilities	Emphasizing awareness raising measures in industrial enterprises and at technical and management level regarding the introduction of energy efficient technologies for new installations; or for rehabilitations ensuring the improvement of the energy efficiency of the existing system.	Ministry of Economy, Ministry of Environment PSRC	State budget	2010 - 2012	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding Source	Duration	Priority
Demand side measures						
IV.2	Implementation of Energy Efficiency Financing Facility for Industrial Enterprises	<p>As already in place in many CEE countries a TA programme and credit line for energy efficiency shall be implemented providing financing means to companies interested in improvements of energy efficiency of their technical processes. The implementation process works usually as follows: (1) performance of energy audits of industrial enterprises by external experts (TA - free assistance); (2) determining the energy savings potential; (3) preparing measures for technical processes improvements or restructuring the operation of enterprises; (4) loan agreements (with more favourable conditions offered through the Facility than the free market).</p> <p>Apart from the existence or implementation of such facility, specific awareness raising measures need to be put in place targeted at management and technical staff to show the benefits of energy efficiency investments:</p> <ul style="list-style-type: none"> - decreased (energy) costs lead to higher competitiveness - improved technical processes leads to improved outputs and increased revenues - reduced company risk increases the value of the company - improving the environment will improve also the company image 	Ministry of Energy, (with support from European Bank for Reconstruction and Development)	EBRD, local banks	2010 - 2015	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
Supply side measures						
IV.3	Electricity savings through improvements of existing electricity network, compensation of reactive power and improvement of transformers	<ul style="list-style-type: none"> o Electricity transmission losses are considerably higher than the international standard of 6-7 percent, at roughly 15 percent. Investments into the network are necessary to reduce high amount of losses and thus contribute to safer supply of energy o Technical losses in the transformers and transformer substations as well as distribution lines are to be tackled, especially on the medium and low voltage systems 	Ministry of Energy, Electric Networks of Armenia	World Bank	2010-2020	High

5.4 **Energy efficiency improvement measures in the transport sector**

Target:	Reduction and minimisation of energy consumption in freight and passenger transport; increasing opportunities for public transport
Target group:	Traffic participants, transport route owners and operators, owners and operators of means of transport, state administration, local and regional governments

5.4.1 **General introduction on the transport sector**

The provision of transport linkages and transit carriages has a key role for the development of trade-economic relations between countries. For all developing countries, especially those which are landlocked as Armenia, it is crucial to implement transit carriages in the light of the tariffs in use and to spur infrastructure development, modernization of available transport stock, etc. The transport policy of Armenia is conducted onwards the creation of integrated Euro-Asian transport network, elaboration of mechanisms for unification of legislative acts and other regulations. Currently, Armenia is implementing the necessary internal state procedures for joining to the existing agreements and conventions in the field of transport, which have been signed in the framework of UN Economic Commission for Europe.

The Republic of Armenia, which has a quite developed network of roads and railways, taking into consideration the specific geographical situation of the country, extends major attention to the modernization of transport infrastructures and for attracting investments in the said sector, especially for the reconstruction of artificial facilities – bridges and tunnels. In regard with its effectiveness, high priority is given to the implementation of combined container carriages and modernization of container terminals.

The major issue, however, remain the quite underdeveloped means of public transportation means across the country (e.g. under-utilised railway system) and especially within its largest city, Yerevan. Individual means of transportation are a huge traffic problem within the city (e.g. there a ten times more minibuses operated than regular larger buses), causing congestion and high emissions from this sector. Moreover, the electrified transport means, such as railway, trolley buses or metro (one line in Yerevan) are playing a very limited role in transport means of the country. The share of different public transportation means in Yerevan (2008) are: trolley buses ca. 3%, metro 4%, large and medium buses 8% and micro buses ca. 85%. The big challenge is increase the share of public transportation systems (large and trolley buses, metro) compared to the high number of micro buses and individual private cars.

5.4.2 **Overview of sector-specific measures**

The energy saving measures for the transport sector include the development of

specific emission norms for vehicles in combination with some incentives to reduce the emission level, further the optimization of vehicles and routes, especially when it comes to the introduction of new energy efficient public transportation to force the replacement of old vehicles with newer, efficient ones, but still maintain the quite unique large share of gas driven cars in the world. The worst polluters are however the large trucks, they are usually least efficient and increasingly congesting roads. Regular inspection programs shall be focussing on the vehicles causing the most pollution, and expanded to other cars like mini buses, taxis and the majority of second-hand car ownership in the country.

One important aspect is related to the creation of awareness among drivers to drive cars efficiently and consider opportunities to reduce the amount of annual mileage. These measures shall be supported by the implementation of traffic demand management schemes which can include a wide range of options (such as parking restrictions or fees, tolls, restrictions by plate numbers) to help ease congestion in bottleneck corridors while promoting public transport.

The proposed measures in the transport sector will account for **approx. 20% of total energy savings projected under the Armenian NEEAP**. The annual % savings including the intermediate energy saving targets up to 2020 are given in Table 11 as follows:

- 2013: 2.3%
- 2017: 10.8%
- 2020: 20.3%

Table 11: Estimated savings per measure in the transport sector from 2011-2020

Sector/Measure		Baseline				Estimated annual savings per measure in % of the											Aggregated savings per measure	
		2008	2009	2010	average 2008-2010	annual/cumulated savings	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
		[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]											
V.	Transport sector					annual	0,2%	0,9%	1,2%	1,7%	2,0%	2,3%	2,6%	2,9%	3,2%	3,4%		
						cumulated	0,2%	1,1%	2,3%	4,0%	5,9%	8,2%	10,8%	13,7%	16,9%	20,3%	20,3%	n/a
V.1	Vehicle Inspection and Maintenance (I&M) program						0,0%	0,5%	0,5%	0,8%	0,8%	0,9%	0,9%	1,0%	1,0%	1,0%	7,3%	n/a
V.2	Traffic Demand Management (TDM) scheme						0,0%	0,0%	0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	3,6%	n/a
V.3	Dissemination of information on technologies and approaches for reducing energy consumption effectively	n/a	n/a	n/a	n/a		0,1%	0,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,8%	0,9%	1,0%	5,5%	n/a
V.4	Continuous exchange of mini buses by larger passenger buses operated by natural gas						0,1%	0,2%	0,3%	0,3%	0,4%	0,4%	0,5%	0,5%	0,6%	0,6%	3,9%	n/a

Table 12: List of measures in the industrial sector specified under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
V.1	Vehicle Inspection and Maintenance (I&M) program	Trucks are often the worst polluters, least efficient and on the road most frequently. Therefore the I&M program should focus on trucks in the beginning (2010-2012). - In a second step, the I&M program could be expanded to minibuses and taxis (2012-2015). In a third step the program can then be expanded to all vehicles (2015-2018).	Ministry of Transport, Ministry of Economy	State Budget	2010-2018	High
V.2	Traffic Demand Management (TDM) scheme	(1) To overcome bottleneck corridors, the city of Yerevan shall prepare a TDM scheme. This could including parking fees, parking restrictions, tolls, restrictions by plate number,... (2) At the same time it is important to promote public transportation (use of metro, buses instead of individual transport). Restrictions for individual transport mentioned under (1) could help to create a shift in the transport modal split towards public transportation means. (3) Optimisation of public transport routes and traffic light management to reduce fuel intensity of vehicles.	Ministry of Transport, Ministry of Economy	State Budget	2010 - 2012	High
V.3	Dissemination of information on technologies and approaches for reducing energy consumption effectively	Dissemination of information to users regarding updated legislation and on ways of economising petrol (e.g. change in air pressure in passenger car tyres, driving skills and others). Especially in the area of heavy traffic (trucks, buses) training of drivers for fuel efficiency shall be encouraged.	Ministry of Transport	State budget International donors	2012 - 2020	High

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
V.4	Continuous exchange of mini-buses by larger passenger buses operated by natural gas	<p>In total, there are about 2,800 mini-buses (10-12 seats) running on Yerevan's public bus routes, only about 300 larger buses (with 25-30 seats). They are operated by private companies that mostly use gas (90%) for driving them due to cheaper running costs. However, mini-buses are one reason for increasing traffic congestion in town which is becoming an environmental problem. The City's plan is to replace in the long term 2 mini-buses by a large bus (also being operated by natural gas, currently at about 50%). This will bring fuel savings at higher capacity and contribute to reducing congestion. Estimated fuel savings is 20-25% per passenger kilometer.</p> <p>The necessary measure is to adapt public tenders for operating bus routes, which are renewed every 4 years, and include large buses as compulsory vehicles. Fuel types have not been specified so far, but as gas is much cheaper than regular diesel or gasoline, the operators will prefer to run gas-operated buses anyway.</p>	City of Yerevan	Private companies (applying for concessions to operate bus lines)	2010 - 2020	High

5.5 *Energy efficiency improvement measures in the water sector*

Target:	Structural reforms in water sector, especially reduction of energy intensity in irrigation systems and for drinking water pumping stations
Target group:	Owners and operators of agricultural businesses / water supply

5.5.1 *General introduction on the water sector*

Armenia has 2.1 million hectares of agricultural land, 72% of the country's land area. Most of this, however, are mountain pastures, and cultivable land is 480,000 hectares (452,900 hectares arable land, 27,300 hectares in orchards and vineyards), or 16% of the country's area. In 2006, 46% of the work force was employed in agriculture (up from 26% in 1991), and agriculture contributed about 21% of the country's GDP. Back in 1991, Armenia imported still about 65 percent of its food.

Agriculture is carried out mainly in the valleys and mountainsides of Armenia's uneven terrain, with the highest mountain pastures used for livestock grazing. Fertile volcanic soil allows cultivation of wheat and barley as well as pasturage for cows, sheep, goats, and horses. The principal agricultural products are grains (mostly wheat and barley), potatoes, vegetables, grapes and fruits (e.g. apricots).

Agriculture provides a significant share in the country's energy demand, mainly through intensive irrigation. Almost 80% of agricultural products are coming from irrigated lands, which generally use electric pumping rather than free-flowing gravity schemes. In former Soviet era, there were about 400 pumping stations in the country, and as electricity always used to be very cheap, nobody cared about the additional irrigation costs. This has changed over the last years, especially due to an initiative started in 2006 by the Millennium Challenge Account-Armenia (MCA-Armenia), a State Non Commercial Organization established by the Government of Armenia and supported by the Government of U.S. through the creation of a foundation. One main focus of MCA-Armenia is to improve current irrigation schemes by converting from pump to gravity-fed irrigation, reducing water losses and improving drainage and thus contribute to a significant energy saving in the agricultural sector.

Another issue is the major energy consumption in the drinking water sector. Support has been given for projects mainly financed by World Bank and USAID to emphasize water sector reform to develop an efficient and sustainable integrated water resources management system. Despite recent improvements in performance of water companies and regulatory institutions, much remains to be done, particularly improvement of water networks in the rural areas. One issue is the rehabilitation and optimization of drinking water pumping stations across the country.

5.5.2 Overview of sector-specific measures

The main measures regarding the water sector addressed in the action plan is following the activities conducted by the MCA Armenia program to rehabilitate existing drainage and pumping systems, rebuild existing secondary and tertiary canals and introduce several new gravity irrigation schemes that will reduce the demand for electrical pumping. This measure does not refer to the agricultural sector only, but optimisation of pumping stations is also a big issue in the drinking water sector and shall focus on water utilities.

Chart 4: MCA-Armenia Irrigated Agriculture Project



Source: MCA-Armenia

The effect of this measure is de facto a decrease of the energy intensity (by about 15% in average), nevertheless the total energy consumption in the irrigation sector is going to increase due to the fact that in most of the projects mentioned in the chart below are also dedicated to increase the amount of irrigated land. As for drinking water pumping stations, it is estimated that a country-wide programme to be implemented could reach a significant saving of up to 10% by 2020. **The total effect on the energy consumption is thus estimated to be roughly minus 14% until 2020.**

The annual % savings including the intermediate energy saving targets up to 2020 are given in Table 13 as follows:

- 2013: 0.7%
- 2017: 3.8%
- 2020: 14.0%

Table 13: Estimated savings per measure in the agricultural sector from 2011-2020

Sector/Measure		Baseline				Estimated annual savings per measure in % of the											Aggregated savings per measure	
		2008	2009	2010	average 2008-2010	annual/cumulated savings	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	[in %]	in TJ
		[in TJ]	[in TJ]	[in TJ]	[in TJ]		[in %]											
VI.	Agricultural sector					annual	0,2%	0,2%	0,3%	0,4%	0,4%	0,9%	1,4%	2,4%	3,4%	4,4%		
						cumulated	0,2%	0,4%	0,7%	1,1%	1,5%	2,4%	3,8%	6,2%	9,6%	14,0%	14,0%	n/a
VI.1	Utilization of gravity flow in irrigation systems and modernisation of existing pumping stations and upgrading secondary and tertiary canals	n/a	n/a	n/a	n/a		0,2%	0,2%	0,3%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	3,5%	n/a
VI.2	Optimization of drinking water pumping stations	n/a	n/a	n/a	n/a		0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	1,0%	2,0%	3,0%	4,0%	10,5%	

Table 14: List of measures in the agricultural sector specified under the Armenian NEEAP

No	Title of the EEI measure	Description of measures and specific actions	Responsibility	Funding source	Duration	Priority
VI.1	Utilization of gravity flow in irrigation systems and modernisation of existing pumping stations and upgrading secondary and tertiary canals	<p>The MCA programme activities foresee the following measures:</p> <p>(1) Installation of 5 gravity schemes (Spitak, Aygezard, Mantash, Shenik, Vardenis) which will rehabilitate in total more than 30 km of existing canals and provide highly improved irrigation.</p> <p>At the same time the possible arable land area will be enlarged; (2) Installation of energy efficient pumping stations: some pumping stations will be rehabilitated and some renewed with efficient pumps, in total 17 pumping stations will be rehabilitated.</p> <p>(3) Rehabilitation of 6 main canals, 250 km of tertiary canals and of Ararat valley drainage system</p> <p>Similar activities are also been supported by the World Bank.</p>	Ministry of Agriculture, Ministry of Energy, Water Committee (under Min. of Territorial Administration)	Millenium Challenge Account - Armenia The World Bank	2010 – 2012	High
VI.2	Optimization of drinking water pumping stations	<p>(1) Elaborate potential assessment for rehabilitation of pumping stations</p> <p>(2) Develop plan for optimisation of most relevant pumping stations across the country</p>	Ministry of Agriculture, Ministry of Energy, Water Committee (under Min. of Territorial Administration)	Drinking water companies	2013-2015	Medium

6 References

1	Law on Energy Saving and Renewable Energy, The Republic of Armenia (2005)
2	National Program on Energy Saving and Renewable Energy of Republic of Armenia, USAID (2007)
3	TORs of the UNDP/GEF project “Armenia - Improving the Energy Efficiency of Municipal Heating and Hot Water Supply”; UNDP/GEF/00035799
4	Scientific Research Institute of Energy for the Alliance to Save Energy/USAID: “National Program on Energy Saving and Renewable Energy of Republic of Armenia”; Yerevan 2007
5	Global Environment Facility - GEF: http://www.thegef.org/gef/gef_country_prg/AM ; (21.7.2010)
6	The Other Renewable Source: The Potential for Improving Energy Efficiency in Armenia, Report to the World Bank (2008)
7	Second Communication of the Republic of Armenia to the United Nations Framework Convention on Climate Change, UNDP/GEF (2009)
8	UNDP/GEF Project Document “Improving Energy Efficiency in Buildings”, UNDP/GEF (2009)
9	World Energy Council : “Energy Efficiency Policies around the World: Review and Evaluation”: http://www.worldenergy.org/documents/energy_efficiency_es_final_online_1.pdf ; (25.8.2010)
10	Towards Energy Efficient Buildings in Europe (2004), The European Alliance of Companies for Energy Efficiency in Buildings
11	Status of Energy Efficiency in the Western Balkans (2010), The World Bank

Annex 1: Template for the calculation of the national energy saving target

	Total final energy consumption Armenia				
	2006	2007	2008	2009	2010
	Unit [TJ]				
Final inland energy consumption within the scope of the EEAP					
Residential/Households					
Industry					
Energy production					
Transport					
Public and commercial services					
Agriculture					
Non-energy use					
Average final consumption over 5-year period:					
Energy saving target adopted in 2020:					
Residential/Households				in %	23,0%
Industry & Energy sector				in %	23,3%
Transport				in %	20,3%
Public and commercial services				in %	14,6%
Water sector				in %	14,0%
Non-energy use				in %	n/a
Total savings (for all sectors)				in TJ	
Intermediate energy saving targets in the years (total):					
[in TJ]				2013	
				2017	
				2020	

Annex 2: Projections of greenhouse gas emissions for Armenia from 2005 to 2020

The GHG projections are taken from the “Second Communication of the Republic of Armenia to the United Nations Framework Convention on Climate Change”. They provide an indication of the development of greenhouse gases that are indirectly also a result of energy use in the country.

The data are based on a 6.0% average annual economic growth and expected volumes of activities in various sectors of economy. Two scenarios of greenhouse gas emissions are being considered – *business-as-usual*, which assumes the continuation of the existing practices and relationships at national level, but also includes certain modernization processes corresponding to international trends, and *rapid stabilization*, which includes measures contributing to the reduction of greenhouse gas emissions planned by national and sectoral development programs.

As a result of the implemented measures, by 2020, greenhouse gas emissions will amount to 61% of their level in 1990 (92% in the case of business-as-usual scenario), but however will almost double in the BAU scenario between 2010 and 2020 (+52% in the stabilization scenario). And the largest share of emissions (73%) will continue to fall on the energy sector.

Chart 5: Projections of greenhouse gas emissions (Gg CO₂ equivalent, excl. LULUCF)

	2005	2010	2015	2020
Business-as-usual	6226	11591.3	18964.8	23125.3
Energy	4315.5	9048.3	15461.2	18471.8
Industrial processes	317.7	505.0	761.0	963.5
Agriculture	1080.3	1430.1	2077.6	2954.8
Waste	509.5	607.9	665.0	735.2
Rapid stabilization	6226	9995.6	15383.4	15216.6
Energy	4315.5	7802.2	12336.7	11108.3
Industrial processes	317.7	395.0	596.0	754.5
Agriculture	1080.3	1402.8	2030.6	2901.6
Waste	509.5	395.6	420.1	452.2

Source: Second National Communication of Armenia to the UNFCCC (2009)

Annex 3: List of relevant donor projects and programs ongoing and of past

GEF Program:

- **Armenia – Improving the Energy Efficiency of the Urban Heating and Hot Water Supply (UNDP)⁷:**

The project aims to reduce greenhouse gas (GHG) emissions resulting from current heat and hot water supply practices in Armenian cities. The project consists of four components: (1) Strengthening the role of condominiums in organizing and managing the heat and hot water supply services at the building level. (2) Supporting the restructuring process and building the capacity of the existing DH companies to improve the efficiency of their operations. (3) Supporting the emerging new service providers in offering their services to the condominiums and structuring financing for the investments needed. (4) Documenting and disseminating the results, experiences and lessons learned nationally and regionally.

The project was approved in May 2003. Total project costs sum up to 12,030,121 US\$ whereof GEF project grant amount to 2,950,000 US\$.

- **Armenia Energy Efficiency Project (IBRD)⁸:**

The Armenian Energy Efficiency Project will reduce energy intensity of the Armenian economy by funding public sector energy efficiency investments and removing existing information, existing information, knowledge, regulatory, and financial barriers that hamper the wide penetration of energy efficiency investments in public buildings and the commercial and residential sectors in the country.

The project was approved in March 2010. Total project costs sum up to around 15,910,000 US\$ whereof GEF project grant amount to 1,820,000 US\$.

- **LGGE Improving Energy Efficiency in Buildings (UNDP)⁹:**

The aim of this project is to reduce GHG emissions and energy consumption in the Armenian buildings sector.

The project was approved in June 2009. Total project costs sum up to around 3,440,450 US\$ whereof GEF project grant amount to 1,045,000 US\$.

⁷ source: <http://gefonline.org/projectDetailsSQL.cfm?projID=1116>; 19.7.2010

⁸ source: <http://gefonline.org/projectDetailsSQL.cfm?projID=3973>; 19.7.2010

⁹ source: <http://gefonline.org/projectDetailsSQL.cfm?projID=3935>; 19.7.2010

World Bank:

▪ **Urban Heating Project – Armenia¹⁰:**

The objective of the Urban Heating Project for Armenia is to support the Borrower to increase the use of clean, efficient, safe and affordable heating technologies in urban schools and multi-apartment buildings. The changes are related to: (1) reallocation of credit proceeds from 'goods and works for others' and 'grants' categories both financing capital grants to the urban poor for gas and heating services to the 'goods and works for school heating systems' category financing rehabilitation of the heating system of urban schools; (2) extension of the project closing date by six months to allow rehabilitation of the heating system of additional schools; and (3) increase of the disbursement percentage for 'goods and works' category of expenses from 80 percent to 90 percent so as to maintain the co-financing requirement by the Government of Armenia on the same level as before the reallocation.

The project was approved in July 2005 and will be closed by the end of 2010. Total project costs sum up to around 21,950,000 US\$ whereof IBRD and IDA commitment add up to 15,000,000 US\$.

▪ **Electricity Supply Reliability and Energy Efficiency Project¹¹:**

The power sector in Armenia addresses four serious challenges: (1) emerging power supply gap, (2) jeopardized power supply reliability, (3) the affordability of energy tariffs, and (4) the financial viability of the sector is threatened; This project will enhance the reliability of the power supply by improving the power transmission network back-bone infrastructure and will reduce the power supply gap by improving the utilization of the country's energy efficiency potential. The project is currently under preparation and estimated to be approved by the board in March 2011. Total project cost are 44,000,000 US\$ whereof IBRD and IDA commitment sums up to 36,000,000 US\$.

¹⁰ source: <http://www.worldbank.org.am/external/default/main?pagePK=64027221&piPK=64027220&theSitePK=301579&menuPK=301612&Projectid=P057880>; 19.7.2010

¹¹ source: <http://www.worldbank.org.am/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=301579&menuPK=301613&Projectid=P116748>; 19.7.2010

INOGATE Programme:

▪ **Harmonization of gas and oil technical standards and practices (E. Europe and Caucasus)¹²:**

The project aims to support the countries' adoption of international standards, rules and practices for design, construction, manufacturing, testing, certification, accreditation, operation and maintenance applied for all main components of gas and oil production / transmission / storage. The project started in December 2007 and will last till August 2010. The total project budget is 2,930,500 €.

▪ **Capacity-building for Energy Regulators in Eastern Europe and Central Asia¹³:**

The project is to promote and advocate good and sound energy regulatory practices in the Partner Countries of the INOGATE Programme and to harmonize energy regulatory practices among them. The project will allow the transfer of EU best practices and the strengthening of cooperation among the countries involved. Furthermore, the project will aim to educate relevant ministerial level decision makers of these countries about the purposes and benefits of an independent energy regulatory organization.

Beneficiary countries are: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine and Uzbekistan; The project started in January 2009 and will last till July 2010. The total project budget is 330,000 €.

▪ **Capacity building for Sustainable Energy Regulation in Eastern Europe and Central Asia¹⁴:**

This is the “successor-project” of the before mentioned one. It started in March 2010 and is planned to last till October 2011. The calculated budget sums up to 505,856 €.

¹² source: http://www.inogate.org/inogate_programme/inogate_projects/ongoing-inogate-projects/inogate_programme/inogate_projects/ongoing-inogate-projects/harmonisation-gas-and-oil-technical-standards-and-80104; 20.7.2010

¹³ source: http://www.inogate.org/inogate_programme/inogate_projects/ongoing-inogate-projects/inogate_programme/inogate_projects/ongoing-inogate-projects/capacity-building-energy-regulators-eastern-46112; 20.7.2010

¹⁴ source: http://www.inogate.org/inogate_programme/inogate_projects/ongoing-inogate-projects/inogate_programme/inogate_projects/ongoing-inogate-projects/capcity-building-sustainable-energy-regulation; 20.7.2010

▪ **Harmonization of electricity standards:**¹⁵

The project's objective is to assist the INOGATE Partner Countries in adopting international standards, rules and practices in the electricity sector. It is anticipated that cooperation on standardization within the framework of the INOGATE Programme will lead to market integration and convergence. The Project seeks to increase infrastructure efficiency, enhance quality and reliability of equipment, ensure safety in electricity transmission and distribution and facilitate trade and investments in modern technologies.

Partner countries are: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

The project started in September 2009 and will last till March 2011. The total project budget is 1,482,500 €.

EBRD:

▪ **Armenian Sustainable Energy Financing Facility (ArmSEFF):**¹⁶

The EBRD's Sustainable Energy Initiative (SEI) was launched in 2006 to address the twin challenges of energy efficiency and climate change. SEI market segments include, besides others, the segment for Sustainable Energy Financing Facilities (SEFFs) through financial intermediaries. One of the long-lasting benefits of this segment is the transfer of specific skills to the local market. In addition to the economic and environmental benefits of the investments themselves, local bank staff becomes familiar with the particulars of sustainable energy investments and in which business sectors to find them; prospective borrowers learn why sustainable energy projects make good business sense and how to finance them.

Moreover local engineers become aware of the best practice investment opportunities and where to identify them. As a result of regular exposure to international experts, this additional capacity builds up from both formal training and on-the-job learning by doing. The project development and implementation legacy that remains will facilitate the financing of future sustainable energy investment opportunities.

This project will start in near future in Armenia.

¹⁵ source: http://www.inogate.org/inogate_programme/inogate_projects/ongoing-inogate-projects/harmonization-technical-standards-rules-and/; 20.7.2010

¹⁶ source: <http://www.ebrd.org/downloads/research/factsheets/sei.pdf>; 20.7.2010

USAID:

▪ **Commercialization of Energy Efficiency Project (CEEP):**¹⁷

This program is working with private sector energy service companies and the banking sector to increase the availability of bank financing for energy efficiency projects to encourage the development of viable energy efficiency market. CEEP was implemented by Advanced Engineering Associates International (AEAI).

It started in June 2007 and will end in November 2010. The project budget sums up to 3,200,000 US.

International Finance Corporation:

▪ **Armenia Energy Efficiency Survey Project:**¹⁸

The main goal of the project is to assess the current market for energy efficiency financing in Armenia and to raise awareness among local financial institutions, small and medium enterprises (SMEs), and policy makers about existing opportunities for energy efficiency financing in the country. By identifying best practices in SME energy efficiency and finance, the survey will also provide benchmarks with other countries and might lead to a more comprehensive program to increase energy efficiency in Armenia and the region.

The project started in 2008 and is still ongoing. It is supported with funds from the Austrian Technical Assistance Trust Fund and IFC.

Millennium Challenge Account–Armenia (MCA–Armenia):

▪ **Irrigated Agriculture Project:**¹⁹

In 2006, the Millennium Challenge Corporation signed a five-year Compact with the Government of Armenia aimed at reducing rural poverty through a sustainable increase in the economic performance of the agricultural sector. The Millennium Challenge Corporation is a U.S. Government agency designed to work with developing countries, based on the principle that aid is most effective when it reinforces sound political, economic, and social policies that promote poverty reduction through economic growth.

MCA-Armenia, a State Non-Commercial Organization established by the Government of Armenia, is responsible for overseeing the transparent implementation of the Compact signed between the Millennium Challenge Corporation and the Government of Armenia.

Presently MCA-Armenia has one major project – Irrigated Agriculture project (USD 120 million) which includes Irrigation Infrastructure Rehabilitation component and

¹⁷ source: <http://armenia.usaid.gov/en/node/270>, 20.7.2010

¹⁸ source: http://www.ifc.org/ifcext/eca.nsf/Content/Armenia_AdvisoryProjects#Armenia%20Energy%20Efficiency%20Survey, 20.7.2010

¹⁹ source: http://www.mca.am/new/enversion/pdf/QB_mca_ENG_13.pdf; 20.7.2010

farmers' assisting Water-To-Market activity (USD 32 million) along with its Institutional Strengthening Sub-Activity (around USD 4 million).