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## NAMA Project Document

# **ENERGY EFFICIENT PUBLIC BUILDINGS AND HOUSING IN ARMENIA**

**Promoting energy efficiency in public buildings and social housing, with particular focus on energy efficiency measures in new construction, capital renovation and in management of buildings of public ownership or financing**

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*The NAMA project document was developed by Mark van Wees, Astghine Pasoyan, and Arsen Karapetyan in the framework of UNDP Programme “Supporting RBEC transition to low-emission development” in close cooperation with the Ministry of Urban Development and the Ministry of Nature Protection*

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# Summary of the NAMA concept

## Background

The concept of low carbon emission development under the United Nations Framework Convention on Climate Change (UNFCCC) provides a framework for countries to formulate their approaches to sustaining long-term national development in the context of mitigation of further increases in greenhouse gas emissions.

Nationally Appropriate Mitigation Actions (NAMAs) are mitigation actions, programmes or policies voluntarily undertaken by developing countries in the context of sustainable development, supported and enabled wholly or in part by technology, financing and capacity building from developed countries. Armenia has voluntarily committed to the Copenhagen Accords to develop and implement NAMAs. As a follow-up, the Resolution of the Government of the Republic of Armenia #1594-N, from 10.11.2011 calls for the elaboration of NAMAs until 2015.<sup>1</sup>

## Economic Benefits of Energy Efficiency

The financial and economic benefits of energy efficiency in buildings are well-researched and documented worldwide, and have also been illustrated and documented in multiple donor-supported pilot projects in Armenia. Many energy efficiency investments have short payback periods due to reduced energy costs (with payback period up to five years). In some cases, integrating energy efficiency in the design of a new building could even reduce construction costs. The economic attractiveness of energy efficiency investments will further increase with rising energy prices.<sup>2</sup> For public buildings this will lead to substantial saving of scarce public funds for construction and operation of buildings.

## Sector Scope of the NAMA Support Project

Improving energy efficiency in the building sector has been assigned high priority in Armenia's climate, energy, and housing strategies. This NAMA will focus on new construction and capital renovation, as well as maintenance/management of those buildings which are supported by public means and/or owned and managed by public institutions. Public means include state budget, IFI loans/grants, municipal budget, public foundations and public-private partnerships.

## Rationale for selecting the NAMA scope

- This building sub-sector is (partly) under governmental control (because (co-)financed) and often under public ownership and management, while the Ministry of Urban Development is the lead state agency in the field of housing construction and urban development. Centralized government involvement and oversight will facilitate the implementation of energy efficiency measures.
- The public sector could set as a good example, in line with the EU energy efficiency policies calling for the state to lead by example.
- Energy efficiency would reduce the energy-related spending from the scarce public budgets for this sector.
- Within the overall framework of the national energy security and growing energy prices, and constrained budget resources for public buildings, energy efficiency is the cheapest way to help reduce country's energy import dependence, curtail the energy expenditures of public budgets, while mitigating climate change.

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<sup>1</sup> See Republic of Armenia's *Note Verbale* under Copenhagen Accord of the UNFCCC at [http://www.mmechanisms.org/document/NAMA/NAMA\\_CPH\\_armenia\\_EN.pdf](http://www.mmechanisms.org/document/NAMA/NAMA_CPH_armenia_EN.pdf)

<sup>2</sup> The natural gas prices increased by roughly 170% from 2008 to 2014 in Armenia; and electricity tariff increased by 35% (day-time), 41% (night-time).

## **Potential for transformational change**

Targeting this sector could secure the necessary market transformation by creating new green jobs, build market capacity in delivering adequate services and materials for energy efficiency, which will have an indirect impact on private buildings (housing and commercial buildings). While many credit lines and financing schemes have been established for leveraging financing for energy efficiency in other sectors, including the existing household apartments, (re)construction and management of public buildings and social housing remains the single untapped sector for potential energy efficiency opportunities.

## **Building on existing activities/ Integration into national or sector strategies**

Previous programs promoting energy efficiency in buildings in Armenia have prepared the essential ground work and basic conditions, such as developing the strategic framework, primary legislation basic regulations, initial awareness raising, and providing evidence of the potential and feasibility of energy efficiency in Armenian circumstances. While the legal-regulatory development has been extensive, the enforcement and large-scale implementation of the energy efficiency upgrades in the construction sector lags. This NAMA will now follow-up by supporting the actual implementation, e.g. by strengthening enforcement of already adopted norms, and by supporting actual energy efficient construction/reconstruction of buildings.

## **Objectives of the NAMA/ Project ambition**

To promote improved energy efficiency, the NAMA project will target the following key objectives:

- Support the policy, regulatory, institutional, and market transformation leading to a higher level of energy efficiency of structures and decreased GHG emissions from the building sector.
- Contribute to improved energy performance of public buildings in health, educational, cultural and other sectors, improving comfort level, cutting public budget allocations for energy bills, while improving the overall quality of public services.
- Support the provision of adequate and affordable housing in Armenia using integrated building design concept, and contribute in reducing the total costs for operation of buildings, decreasing public costs and costs for the users/clients.
- Contribute to the development objectives of Armenia (environment, economic, and social), related to the construction and building sector.
- Support transformational change to a low-emission development path in the longer term.
- Contribute to improving Armenia's energy security.

## **Stakeholders and organization of the NAMA/ Target group**

- The Ministry of Urban Development (MUD) is responsible for the construction and building policy and regulation, and for overseeing the dominant part of investments in this sector. Energy efficiency is included in its Charter as a functional task area. The MUD also is the largest developer of public buildings in the country through its Urban Development Projects Implementation Unit (PIU). It is proposed that the MUD takes the lead in developing and implementing this NAMA, potentially through the Urban Development PIU. This could be done in close cooperation with the Ministry of Nature Protection (MNP) and the Climate Change Information Center of MNP.
- The development of this NAMA proposal is supported by the United Nations Development Programme (UNDP), which is committed to support further the implementation of the technical assistance and support activities under this NAMA.
- Investments in this sector are implemented through different sectoral Project Implementation Units (PIUs) established by the Government with state budget, grant or IFI loan funds, municipalities

(including Yerevan), and other public institutions (including the “Hayastan” All-Armenia Fund). These institutions will play a key role, both as targeted beneficiaries, as well as implementing partners.

- The NAMA will target to involve and support the main actors engaged in the project/investment and maintenance cycle: policy makers, regulators, sponsors, developers, architects, designers, contractors, suppliers/manufacturers, inspectors, auditors, maintenance, and clients/users of buildings.
- The NAMA focuses on implementation of energy efficiency in buildings and, as such, builds on the results of previous activities promoting energy efficiency, such as the “Improving Energy Efficiency in Buildings” UNDP-GEF project and “Energy Efficiency Project” WB-GEF. These projects have prepared a ground by providing essential empirical evidences from pilot projects, tested technological solutions, trained experts, developed a set of norms and regulations covering building energy passportization, performance assessment, energy auditing, etc.

### **NAMA components, activities and implementation**

- The NAMA support program will address the main barriers and provide support to: reforming sectoral policy and strategies, accelerating the development and enforcement of ambitious regulatory framework, building capacity and raising awareness, as well as eliminating financial barriers.
- All relevant practices, measures and technologies for energy efficiency will be considered, including energy efficient design with incorporation of passive solar, efficiency upgrades to building envelop, heating/ventilation/cooling system, renewable energy applications in the buildings, high-efficiency heating systems, etc. The energy efficiency in building operation, maintenance and the use will also be addressed.
- Assuming partners/donors/financiers could be found, the activities will start in 2015. The 1st phase of the NAMA will cover the period of 2015-2020. The NAMA support program target beneficiaries and leveraged national actions are lined up for this timeframe.

The following NAMA-components are proposed:

1. Investment grants to cover (initial) incremental investment costs for energy efficiency in new construction and rehabilitation (public buildings, social housing) for planned investment programs;
2. Investment program for energy efficient rehabilitation/construction of public buildings, additional to planned investment programs through leveraging low interest concessional loans, with higher energy efficiency requirements;
3. Technical support and capacity building, supporting component 1 and 2 through outreach, capacity building, strengthened policy enforcement, as well as strengthening building management/maintenance.

### **Costs and financing for implementation**

- Detailed costs and budget for implementation of the NAMA are to be determined based on envisaged measures; however strongly depend on the available national and international support.
- The NAMA will require the following means of support: financial and technical support/assistance and could be financed through (a combination of) different sources: state and local public budgets, private sector contribution and international support (grants, concessional finance).
- Tentatively, costs are estimated at: USD 2-4 million investment grant for incremental energy efficiency costs in planned public investment programs (component 1); concessional loans of USD 10-30 million for new energy efficient renovation programs in public buildings (component 2) and, USD 1-2 million for technical assistance/support (component 3).

### **Measuring, reporting and verification (MRV)**

A framework will be set up to systematically monitor, report and verify the impact of the NAMA. This includes the following aspects:

1. Impact on greenhouse gas emissions compared to a baseline business- as-usual scenario.
2. Contribution to the national sustainable development objectives. This includes social inclusion, poverty alleviation, new job creation, energy security and gender aspects.

### **Impact on transformation to low carbon development**

The impact of the NAMA on GHG emissions falls into 3 categories:

1. Improved energy efficiency in planned and projected public investment programs for new construction and renovation programs (NAMA component 1). An initial evaluation has been made on the reduction of energy use and its impact on reduction of GHG emissions.
2. New construction and renovation programs with higher energy efficiency requirements (public buildings) through involvement of concessional loans (NAMA component 2). An initial evaluation has been made on the reduction of energy use and its impact on reduction of GHG emissions through existing opportunities.
3. Indirect impact on energy efficiency in other (private) building sectors.

# 1 Foreword and introduction to the NAMA concept

## Background to this document

Armenia has no domestic resources of fossil fuels and strongly depends on imported primary energy resources to meet its energy demand. Armenia has significant renewable energy resources. Increased use of small hydro, wind and solar energy has a technical potential of increasing Armenia's renewable energy use tenfold by 2020. Maximal utilization of renewable sources of energy and energy efficiency are therefore top priorities for Armenia.

The concept of Low-Emission Development under UNFCCC provides a framework for countries to formulate their approaches to sustaining long-term national growth in the context of mitigation of further increases in greenhouse gas emissions. A special support mechanism for Nationally Appropriate Mitigation Actions (NAMAs) is established under UNFCCC as well as a NAMA registry. The Green Climate Fund (GCF) to support NAMAs is under development.

NAMAs are mitigation actions, programmes or policies voluntarily undertaken by developing countries in the context of sustainable development, supported and enabled wholly or in part by technology, financing and capacity building from developed countries. An overview of NAMAs in preparation/development can be found in a variety of sources the major reference sources of which are the UNEP RISOE NAMA Pipeline Analysis and Database, the UNFCCC NAMA registry and the Ecofys NAMA Database.<sup>3, 4, 5</sup>

With UNDP support to Armenia, the necessary documents for NAMAs can be developed enabling the country to benefit from the international support provided for their implementation. Armenia could use UNDP's experience in energy efficiency in buildings to develop more comprehensive measures in this area under the NAMAs mechanism. This will help to ensure complementarity of the GEF and NAMA funding.

## Methodology for NAMA development

The graph below illustrates the full life cycle of a NAMAs.

### 10 Steps to a NAMA

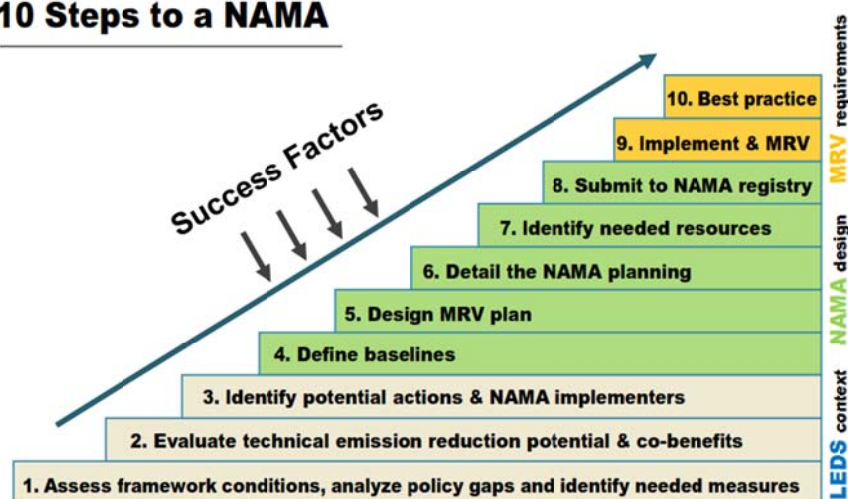


Figure 1: 10 steps in developing a NAMA<sup>6</sup>

<sup>3</sup> UNEP Risoe NAMA Pipeline Analysis and Database. <http://namapipeline.org/>

<sup>4</sup> UNFCCC NAMA registry [https://unfccc.int/cooperation\\_support/nama/items/7476.php](https://unfccc.int/cooperation_support/nama/items/7476.php)

<sup>5</sup> Nama database Ecofys. <http://www.nama-database.org>

<sup>6</sup> NAMA Tool GIZ [http://mitigationpartnership.net/sites/default/files/7.\\_giz\\_nama\\_tool\\_8\\_6.pdf](http://mitigationpartnership.net/sites/default/files/7._giz_nama_tool_8_6.pdf)



The work in preparing the project document encompassed step 1 to 7, with step 8 (registration) planned on the basis of this document. Obviously, given the early stage of NAMA preparation, an iterative approach is needed, revisiting previous steps if necessary, on the basis of stakeholder consultations and other feedback.

#### **Results of Round Table on 23 May 2014**

A Round Table on transformation to low carbon development in Armenia was organized with UNDP support on May 23<sup>rd</sup>, 2014 in Yerevan with participation of the most relevant stakeholders, including the MUD, Ministry of Energy and Natural Resources, Ministry of Territorial Administration, Yerevan Municipality, the Renewable Resources and Energy Efficiency Fund, other energy sector stakeholders, NGOs, project-implementation units, academia, etc. This NAMA concept was presented and discussed with stakeholders. Key comments from the Round Table have been incorporated in this document. The overall conclusion of the round table was that this NAMA is appropriate, needed and supported by the stakeholders.

#### **Purpose of this document**

The purpose of this NAMA project document is the following:

- Provide the information for registration at the UNFCCC registry (see the Annex.<sup>7</sup>).
- Provide background to the discussion and raising the interest of potential financiers and donors.
- Serve as a reference (and as a working document) for continued discussion with national stakeholders for the purpose of further preparation and implementation of the NAMA support project.

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<sup>7</sup> [https://unfccc.int/cooperation\\_support/nama/items/7476.php](https://unfccc.int/cooperation_support/nama/items/7476.php)

## 2 Sector information

This chapter presents the background on the building/housing sector and in particular on the construction, renovation and building management activities, on which the NAMA will focus. This includes two subsectors:

- Public buildings constructed or rehabilitated and/or managed by public institutions and with public funds;
- Residential housing that is constructed/rehabilitated and/or managed with support from public means, in particular social housing and housing under public-private partnership (PPP) scheme.

### 2.1. Overview of the public buildings sector

Public (or institutional buildings) are used for the following activities focusing on not-for-profit services in the public's interest, including:

- Educational facilities (including universities, schools, kindergartens, art and athletic schools),
- Health (including hospitals, clinics, ambulatories, polyclinics),
- Social buildings (elderly houses, orphanages),
- Juridical buildings (courts, prisons),
- Cultural and multipurpose public facilities (museums, archives, libraries, theatres, concert halls, etc.),
- Offices/administrative buildings (including offices for national, regional and local government).

Most public buildings are under mixed ownership and jurisdiction of line ministries, regional authorities, local authorities, state property management department, mixed public-private ownership entities.

New construction, reconstruction and capital renovations are mainly financed by the state budget, regional or municipal budgets, IFI loans or charities/benefactors. Currently, accurate statistics on the number of public buildings, floorage, typology and use is not available. As a rule of thumb, public buildings comprise about 25% (in floorage) of the total floorage of the building sector.<sup>8</sup> This sector faces persistent budget limitations. Moreover, the financing is assigned in the public sector from the public budgets per person (e.g. per pupil in schools, per patient – in hospitals, etc.), without consideration of low occupancy, seasonal flows, resulting in forced compressed energy demand and poor state of repair.

The comfort and budget pressures have further been aggravated by the growing energy prices, specifically:

- Gas prices increased ~170% from 2008 to 2014;
- Electricity prices increased 67% (day-time), 212% (night-time) since 2009, the most recent price hike registered in August 2014.<sup>9</sup>

Energy costs (mainly for heating) are generally the second highest (5-20% of total costs) for public sector. It is the need to stay within given budget, that result in under-heating in most public buildings. Surveys show that the average comfort level in social buildings is about 40% (suppressed demand).

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<sup>8</sup> Rule of thumb originating from Soviet times

<sup>9</sup> During 2006-2009 the tariffs were the following: day-time 25AMD/kWh, night-time 15 AMD/kWh. They were increased up to 38 AMD/kWh and 28 AMD/kWh, respectively in 2010-2013. Effective August 1, 2014 – daytime tariff is 41.85 AMD/kWh, night-time 31.85 AMD/kWh. Source: [www.psrc.am](http://www.psrc.am)

## **2.2. Overview of the planned construction/renovation in public buildings and housing supported by public means**

### **2.2.1. Residential building stock**

More than half of the population of Armenia lives in apartment buildings (around 430,000 apartments). 75% of all the apartment buildings were built within the period of 1951-1990. Additional wall insulation has not been applied to the majority of buildings during construction. Families spend significant percent of their income on apartment heating, while the price of energy keeps rising.

Armenia has a rapidly aging building stock, largely comprised of either stone buildings or prefabricated panel, in addition to private 1-2 floor homes. The energy saving potential may vary by building types, and as the prefabricated panel buildings usually completely lack insulation they have the largest potential for energy saving.

### **2.2.2. Historical investment in building construction**

Despite the budget limitations and financial crisis impacts, the construction sector has remained quite substantive among the sectors attracting investments. As indicated in the graph below, the historical investments in the construction sector have been well over \$1 billion per year, of which the state budget financed about 17%.<sup>10</sup> The construction of public buildings and social housing (about 9% of total construction), requires state financing of about \$100 million per year. A similar amount is invested by the state budget annually in the other sectors of public construction, including maintenance of existing assets, construction of industrial buildings, infrastructures, etc.

In the past period, housing issues of refugee families, residential houses in landslide areas, people left homeless as a result of bombings, houses damaged in the consequence of the earthquake, and those left homeless for other reasons – almost 9000 families, have been resolved. The RA Ministry of Urban Development in the period of 2003-2012 constructed 458 buildings including 11 for administrative, 271 for educational, 63 for cultural, 28 for regional, 19 for healthcare and 65 for residential use (including 2908 apartment). Additionally, the MUD constructed 875 single-family cottages.

Some efforts of the State in the field of developing social housing have been coupled with the efforts of the donors including the Swiss Development and Cooperation (SDC) and the United Nations Refugee Agency (UNHCR). The MUD policies and programs indicated that while the ongoing efforts are mainly based on the state budget funds and allocation of state assets, the long-term objective of the MUD is as to establish a workable scheme for public-private partnerships (PPP).<sup>11</sup> The Armenian Government remains committed to seek resources and gradually resolve the housing issues for the remaining 30,000 families in immediate need of permanent housing.

UNDP has completed full EE retrofitting works of one 9-storey residential building and finalized full monitoring of the energy performance before and after implementation of energy efficiency measures..

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<sup>10</sup> National Statistical Service reports 2012

<sup>11</sup> Strategic Program on Development of Social Housing Fund adopted by Protocol Resolution No 26 of the Government of RA on 26 December 2013

During 2007-2010, 24 socially-oriented energy-efficiency and renewable energy projects were designed and completed for a total cost of about \$700,000 USD, over 25,000 people benefited from these projects. As a result, 14 business models for the most viable market segments were prepared and shared with energy sector SMEs to help develop bankable projects.

Energy audits of multiple residential buildings proposed a standard set of measures which can bring to as much as 65% energy consumption reduction:

- Insulation of external walls,
- Replacement of windows and entrance doors,
- Windows replacement by walls (reduction of window area),
- Roof insulation.
- Installation of gas boilers with high efficiency (92%) for space heating, with possibility to demand side management t (thermostat control, consumption based billing).

Other measures (including heat pumps, solar water heaters, etc. can be considered upon availability of additional financing).

### **2.2.3. Planned investment programs in energy efficient construction and renovation of public buildings and social housing**

Some of the investments in building reconstruction and new construction have been ongoing through targeted programs, including those which have been selected into the NAMA scope. They include the following construction, capital reconstruction, repair and retrofitting of existing public buildings by public funds (state-funded or borrowed public funds), and charity as well as construction or social housing including:

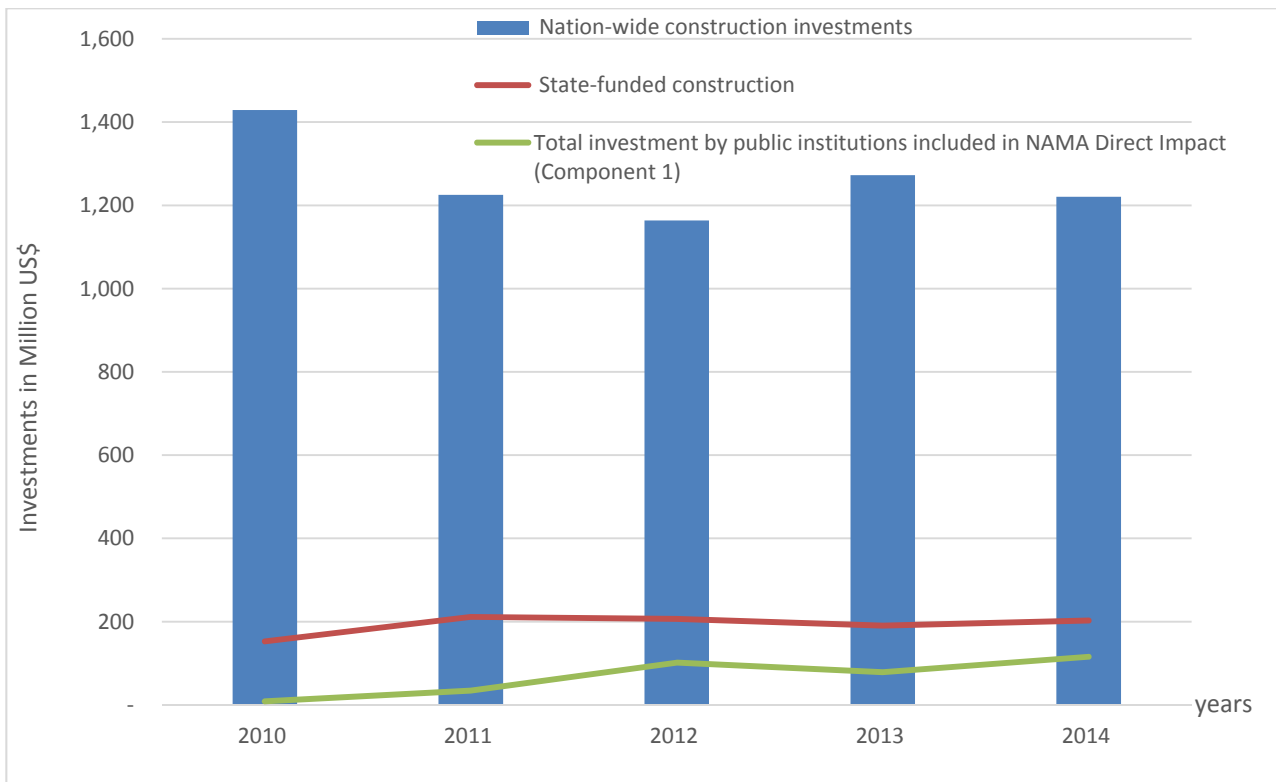
- Ministry of Urban Development through the Urban Development Projects implementation unit (PIU),
- Yerevan Municipality
- WB Social Investment Fund
- WB Health PIU
- WB Educational PIU
- “Hayastan” All-Armenia Foundation

EBRD, on the other hand, has been working with MUD to assess the market for residential energy efficiency lending which would target the energy saving potential in existing residential buildings.

Habitat for Humanity Armenia has worked with Inecobank on residential energy efficiency upgrades serving a total of 99 families in 3 buildings, with a total disbursement of roughly USD\$ 6,000 per building.

Numerous commercial banks have access to credit specifically for energy efficiency activity (for example Inecobank has received USD \$10 million and Ararat Bank USD \$5million for EE loans from the Green for Growth Fund, IFC is working with Byblos Bank and the AFD with National Mortgage Company on household energy efficiency loans and EE mortgage loans, Ameria Bank also has a household EE Loan product.).

The state has invested in many other sectors including rebuilding housing in the earthquake recovery zone, rural development, infrastructure, etc. The historical investments since 2010 are graphically presented below.



**Figure 2. Overall investments in construction sector, including public institutions covered under NAMA direct impact (Component 1)**

Source: National Statistical Service

However, many of the above investments are implemented ignoring the energy efficiency requirements of the building codes and the economic, environmental and social advantages that energy efficiency offers. Some of the benefits of energy efficiency in buildings are presented below:

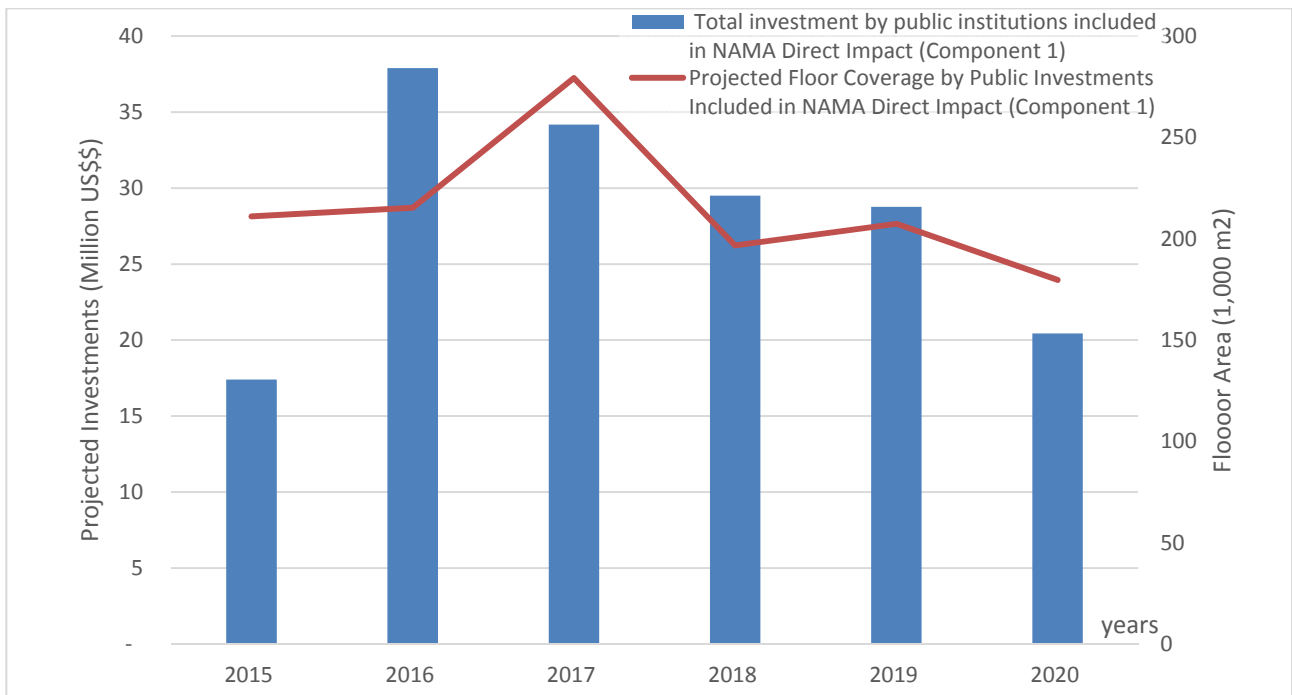
### Benefits of energy efficiency in buildings

- The financial and economic benefits of energy efficient building are well-researched and documented.
- Improving energy efficiency in the building sector has high priority in Armenia’s climate, energy, and housing strategies. The more than 40% of the primary energy resources are consuming in the building sector.
- Energy efficiency in new construction could be substantially cheaper than in existing building and could, in some cases, even reduce construction costs.
- Many other energy efficiency investments have short payback periods in terms of reduced energy costs (payback period below a few years).

The profitability of energy efficiency in buildings will further increase with rising energy prices, and for public buildings this will result in substantial saving of scarce public resources for low-energy building construction and building operation.

In the light of the above, the NAMA aims to improve energy efficiency in new construction and capital renovation of public buildings and housing supported by public means (social housing and PPP housing). To estimate the potential direct impact of the NAMA, an initial inventory was made of the respective planned investment volumes in the period till 2020 under this scope.<sup>12</sup>

<sup>12</sup> While the actual investments in public buildings and social housing will likely be substantially more, the investments analyzed within the direct scope of the proposed NAMA support project are solely based on actual funding arrangements formally committed to by the authorities/financiers.



**Figure 3. The Projected investments and coverage within the direct impact of the NAMA for 2015-2020**

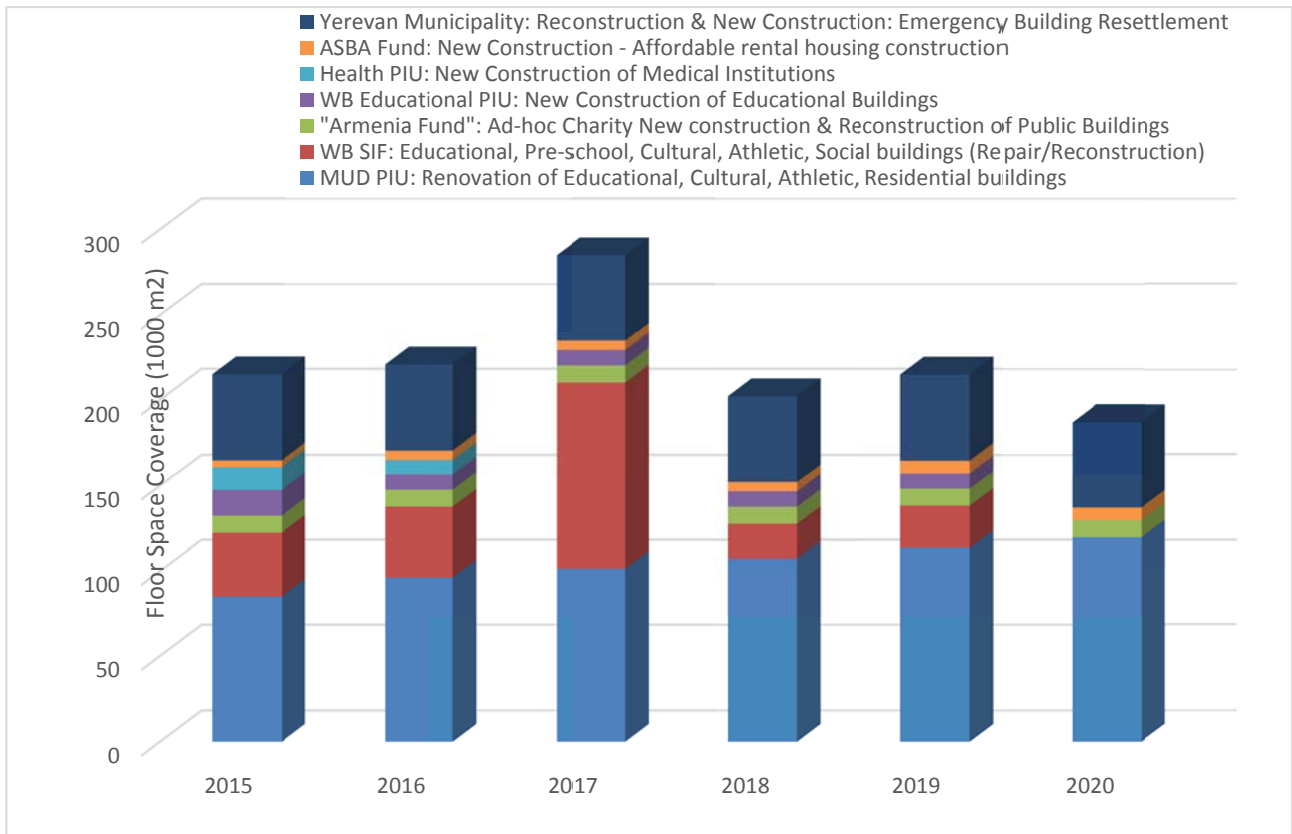
*Source: Data collected by UNDP Experts*

The graphs give an initial overview of projected/planned construction volume (floor area) and investment volumes of new construction and capital renovation of public buildings and housing supported by public means. While the actual investments in this sector will be continuous, the concrete budget and coverage commitments are projected based on specific approved programs.

The information is collected from the responsible organizations (developers, budget holders, municipalities, PIUs, etc.) and is based on: 1) approved budgets and plans; 2) if latter not available, on budget/program proposals and/or projections. As most investment programs cover a few years only, the estimates up to 2020 are projected from the shorter term figures. It is highly probable that the investments will continue in their regular extension cycles, however, there were no official documents for such presumption. More details can be found in Annex A, which provides detailed information on volumes, typologies and developers/supervising institutions.

An overall cumulative investment of about \$200 million is planned/projected over the 2015-2020 period and will potentially be invested in capital reconstruction and new construction of public buildings and social housing, equivalent to over 1.3 million square meters in schools, hospitals, kindergartens, housing, etc.

The projected investment volumes are conservative and substantially lower than the common trend over the past ten years because they are solely based on ongoing programs and do not forecast beyond the scope of the lifespan of the ongoing programs. The inventory will be continuously updated during the preparation of the NAMA and it is very likely that other construction/reconstruction funds/programs will be implemented concurrently.



**Figure 4. Volumes of investment programs (planned and projected, expressed in area of 1000 m<sup>2</sup>) in new construction and renovation of public buildings and social housing**

Source: Survey of public institutions and project implementation units conducted by UNDP experts



**Figure 5. Budgets of investment programs (planned and projected) in construction and renovation of public building and social housing**

Source: Survey of public institutions and project implementation units conducted by UNDP experts

### 3 National policy context

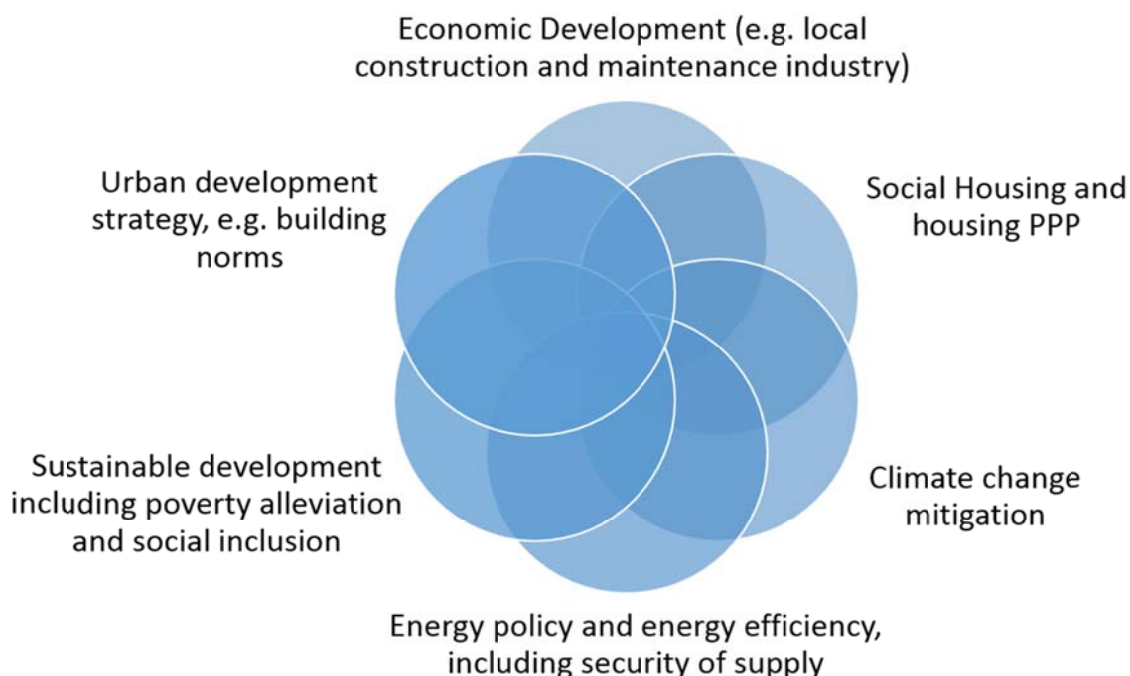
#### 3.1. Introduction

To date, the accumulated experience and expertise have demonstrated that energy efficiency improvements can help public organizations and vulnerable households in Armenia and neighbouring countries, and that energy efficiency is the quickest, cleanest and cheapest way to bring comfort and economic mitigation to these households. The age, violations of energy norms during construction, poor state of repair and maintenance collectively make public and residential buildings inefficient, creating a large potential for energy efficiency in the buildings sector. The National Program on Energy Saving and Renewable Energy estimates 40 % potential for energy saving in Armenia’s building sector which can be achieved through thermal insulation alone.

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

Buildings are an important component in a country’s economy, society and culture. People live, work and meet in buildings. In Armenia, natural disasters in the past have caused a shortfall in adequate housing, and many families cannot afford suitable housing yet. According to the Ministry of Urban Development, 30,000 families still residing in temporary housing are in desperate need for social housing. Public budgets are not sufficient to fully address the social and economic development needs related to buildings.

The national policy context for the proposed NAMA covers, therefore, the following, increasingly interlinked, policy and legislative/regulatory fields:



**Figure 6 Policy areas related to energy efficiency in public buildings and social housing**

These policy areas are discussed in the next sections.



### **3.2. Climate policies in Armenia**

#### **Armenia's position in the UNFCCC**

Under the UNFCCC, Armenia is encouraged to build capacity and engage in the new carbon market mechanism to be developed following the 17th and 18th sessions of the UNFCCC Conference of the Parties. Armenia is also encouraged to make additional efforts to fully implement the Cancun and Durban decisions and in particular devise a low-carbon development strategy.

The concept of low carbon emission development under UNFCCC provides a framework for countries to formulate their approaches to sustaining long-term national development in the context of mitigation of further increases in greenhouse gas emissions.<sup>13</sup>

Armenia has already submitted its voluntary political commitment to reduce GHG emissions associating with UNFCCC Copenhagen Accords, and communicated its mitigation priorities, including the implementation of a “National program on energy saving and renewable energy”, including also measures aimed at improvement of energy efficiency in buildings and constructions.

Actions under this program were not divided into the autonomous and internationally supported and besides the usual mitigation measures - such as energy efficiency and renewable energy and mitigation measures in transport sectors, measures were envisaged in the waste management and forestry sectors as well.

#### **Background to NAMAs in Armenia**

Armenia has voluntarily committed to the Copenhagen Accords to develop and implement NAMAs. A 5 year Action Plan on implementation of the UNFCCC commitments, including the development and approval of the NAMA Program by 2015, was adopted by the Resolution of the Government of the Republic of Armenia #1594-N, from 10.11.2011, which stipulates elaboration of NAMAs until 2015.

### **3.3. Policy and legislative framework on public support to housing (social housing and PPP)**

#### **Housing for vulnerable groups, and low and middle income households<sup>14</sup>**

The provision of adequate, affordable, efficient and well managed housing is a political, economic, and social priority in Armenia. The need for government intervention in the housing sector, in particular by (co) financing and managing certain housing sectors for certain groups, is, therefore, recognized by the Armenian government, by the regional and local government, and by societal stakeholders in Armenia. Two categories could be distinguished:

- *Humanitarian social housing*, intended for vulnerable groups, such as refugees, who cannot significantly contribute to the housing costs. Many citizens are still in need of housing, including inter alia those suffered from the earthquake. The housing is government/donor funded and the stock is often owned/managed by municipalities.
- *Affordable housing for low to middle income groups (financed and developed through Public Private Partnership PPP)*. A large share of the Armenian population has no access to affordable and decent houses, because they lack the finances to purchase or rent housing on the (commercial) markets. The sector can use public subsidies (local and national) to subsidize housing costs making the housing affordable for the target groups (low to middle income). It allows for professional, efficient and adequate management and maintenance. Finally, it promotes innovative public-private partnerships in project development and financing. This is a new concept in Armenia: the first National Social Housing Association ASBA was established in 2011.

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<sup>13</sup> Armenia participates in the regional EU ClimaEast project that will be implemented in the period 2013-2016 that aims to support these activities.

<sup>14</sup> This sector is often referred to as “social housing”.

Increasing energy tariffs are a potential cause for further impoverishment for both population groups, but in particular for the vulnerable and lower income groups.

### **Policy and legislative framework**

- In 2013, the Government of Armenia has adopted the National Strategy on Developing Social Housing Stock for a period of 2014-2025 and Action plan for implementing the strategy for 2014. According to the Strategy and Action Plan, the Ministry of Urban Development and Ministry of Labour and Social Affairs (MLSA) are the main Government bodies responsible for the implementation of the Strategy.
- The newly approved Strategy calls for developing selection criteria and process for identification and execution of projects for developing social housing stock in the country. The Strategy calls for extensive inclusion of energy efficiency measures in developing and maintaining the social housing stock. However, the State is still to identify the sources of financing for its implementation via construction, purchase or rental of affordable housing, potentially through public-private partnership schemes.
- The Action Plan for 2014 assumes several preparatory steps by the MUD and MLSA with regard of social housing initiatives before making allocations in the State Budget of the Republic of Armenia for 2015. One of critical steps is developing selection criteria and model project(s) for social housing investment initiatives, both for state funded and for public-private partnership initiatives.
- The National Housing Council is the main State body in charge of developing selection criteria and methodology for identification and selection of investment projects. SNCO “Service Center for Social Housing Stock” is the main government entity for managing and maintaining the existing and newly created state social housing stock for vulnerable groups.<sup>15</sup>

### **3.4. Policy and legislative framework of energy efficiency in buildings**

- The improvement of energy efficiency in buildings and construction is a priority under Armenia’s association to the Copenhagen Accords. The promotion of energy efficiency in public-supported housing and in public buildings should be a priority as this sector is (co-) financed by public resources and, in most cases, managed by public institutions.
- The National Program on Energy Saving and Renewable Energy of the Republic of Armenia (2007) is currently being implemented through the National Energy Efficiency Action Plan (2010). The Plan identifies measures, including new building codes, financial schemes for retrofitting public buildings and certification systems for construction materials.
- The energy efficiency and energy saving related tasks and functions were added in the MUD charter just one year ago by the Government decision N225-N dated March 134, 2013. According to 2014 Action Plan the MUD is currently elaborating a draft government decision “On application of measures directed towards increasing of energy saving and energy efficiency in objects constructed (reconstructed, renovated) by the state means”.
- Amendments to the Law on Energy Saving and Renewable Energy and the Law on Urban Development underway for 2014 establishing mandatory legal provisions for building energy efficiency and to reinforce building energy efficiency codes;
- The National Energy Security Concept adopted on 23 October 2013 emphasizes the importance of energy efficiency in general, and the need to increase the state and private investments in the building energy efficiency, in particular.
- Since 2004 Armenia has been involved in European Neighbourhood Policy (ENP). The ENP Action Plan was approved in 2006 and will support the harmonization of Armenian legislation, norms and standards with EU criteria. EU energy efficiency standards are being transposed, and the revision of the Building Code and the transposition of the EU Energy Performance in Buildings Directive through a national Technical Regulation on Building Energy Efficiency is in process (supported by an UNDP-GEF project).

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<sup>15</sup> To date, the NHC is not operational

- A 5 year Action Plan on implementation of the UNFCCC commitments, including the development and approval of NAMA Program was adopted in 2011.

### **3.5. Sustainable Development Strategy**

- The Sustainable Development Program of Armenia adopted in 2008 has no specific reference to climate change mitigation and low emission development.<sup>16</sup> The 2008 Program was revised in November 2012 and the Strategic Program for Sustainable Development for 2014-2025 was adopted (Government Resolution No 442N from 27 March 2014), which emphasized that importance of improving the building conditions of educational, cultural, and judicial institutions.<sup>17</sup>
- The Rio+20 report of the Republic of Armenia<sup>18</sup> outlined the key directions of the 2014-2025 program above, and outlined some of the priorities including the problems of the capital City of Yerevan related to on-going urban development, where since 1997-98, the launch of spot construction with multi-storey buildings has often been at the expense of green zones, playgrounds and other public space, creating unprecedented density, contraction of green areas, climate change, and growth of seismic risks of the city, particularly the Centre. This hampers sustainable urban development and violates the principles of European Landscape Convention, which Armenia has joined. In order to coordinate the activities in the “Post-Rio+20” direction in the Republic of Armenia, an inter-agency committee was established with the representatives of the respective government agencies, civil society and academia.
- Within the Post-Rio +20 process the MUD, in turn, has established a targeted inter-agency sub-committee on “Sustainable Cities/ Green Architecture Development”.
- Evaluation framework for impact in key sustainable development indicators has been developed for climate mitigation projects, in particular for CDM in Armenia. This framework will be used for an initial ex-ante evaluation of the proposed NAMA project co-benefits.

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<sup>16</sup> Annex to RA Government Decree N 1207-N, October 30, 2008.

[http://www.nationalplanningcycles.org/sites/default/files/country\\_docs/Armenia/ndp\\_armenia.pdf](http://www.nationalplanningcycles.org/sites/default/files/country_docs/Armenia/ndp_armenia.pdf)

<sup>17</sup> Government Resolution with Strategic Development Program for 2014-2025 available at

<http://www.mtc.am/edfiles/files/voroshumner/442.1k.voroshum-1.pdf>

<sup>18</sup> Available online at [http://sustainabledevelopment.un.org/content/documents/800Armenia\\_Report\\_Final.pdf](http://sustainabledevelopment.un.org/content/documents/800Armenia_Report_Final.pdf)

## **4 Drivers and barriers for energy efficiency in public buildings and social housing**

### **4.1. Benefits and drivers of energy efficiency in buildings**

The financial and economic benefits of energy efficient building are well-researched and documented internationally. Many energy efficiency investments have a short payback periods in terms of reduced energy costs (payback period below a few years). In some cases, considering energy efficiency in the design of a building, it could even reduce construction costs. The few studies considering the national circumstances of Armenia (construction costs, established market prices for construction materials, heating, conditioning and ventilation costs) confirm these findings.<sup>19</sup>

The profitability of energy efficiency will further increase with rising energy prices. This will for public buildings and social housing result in a substantial saving of the scarce public resources for construction and operation of buildings.

### **4.2. Barriers for energy efficiency in public buildings and social housing**

#### **New construction and renovation**

A number of institutional and organizational factors contribute to wasteful or inefficient use of energy in public buildings, including:

- Lack of attention and leadership on energy efficiency from top management and elected officials due to higher priorities in other sectors of social importance.
- Fragmented responsibilities for energy management and capital investment among several agencies or departments of the same government (such as, a "landlord" government services agency (e.g. Ministry of Health for hospitals, Ministry of Education for schools, etc.), tenant organizations, the Ministry of Finance, design and construction authorities).
- Budget constraints and a limited ability to commit to a multi-year financial obligation such as a third-party energy performance contract or lease of efficient equipment.

When the motivation is found and the funding is secured, there will still be persisting barriers to effective realization of energy efficiency improvements in public buildings, including the following:

- The energy efficiency investments often cannot be implemented alone, due to the major need for capital renovation, for which there is lack of sufficient funds;
- Financing per person (per student, per patient, etc.) with the level not sufficient to cover fixed costs of building maintenance;
- Actual occupancy being less than planned for a given public building;
- Budget constraints for current expenditures resulting the lower comfort level, which -in turn- reduces the economic viability of energy efficiency investments;
- Low comfort level (caused by the need to meet budget limits), e.g. reduced used area, lower in-door temperature, which brings to the worsening of the quality of the public/municipal services offered by the public building, resulting in social, health and other cross-cutting disadvantages.

#### **Management and operation of public buildings and social housing**

- Lack of direct incentive for the agency managing and operating the building to save energy or reduce operation costs (for instance, the agency may not pay utility bills or even rent; and savings go back to the

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<sup>19</sup> The 2007 National Program of RA for Energy Saving and Renewable Energy estimated a total annual energy saving potential in the building sector equivalent to 331 ktOE through improvement of thermal protection of buildings, introducing energy efficient lighting and heating systems.

general budget and are not available to the agency for other purposes, such as energy efficiency measures).

- Limited in-house technical capacity and skills for efficient management of energy use - which is worsened by rapid staff turnover.
- Lack of skills in maintaining building installations.
- Lack of involvement of the final users of the building in operation and management of the building.
- Lack of legal requirement for periodic energy audit and building energy performance certification.

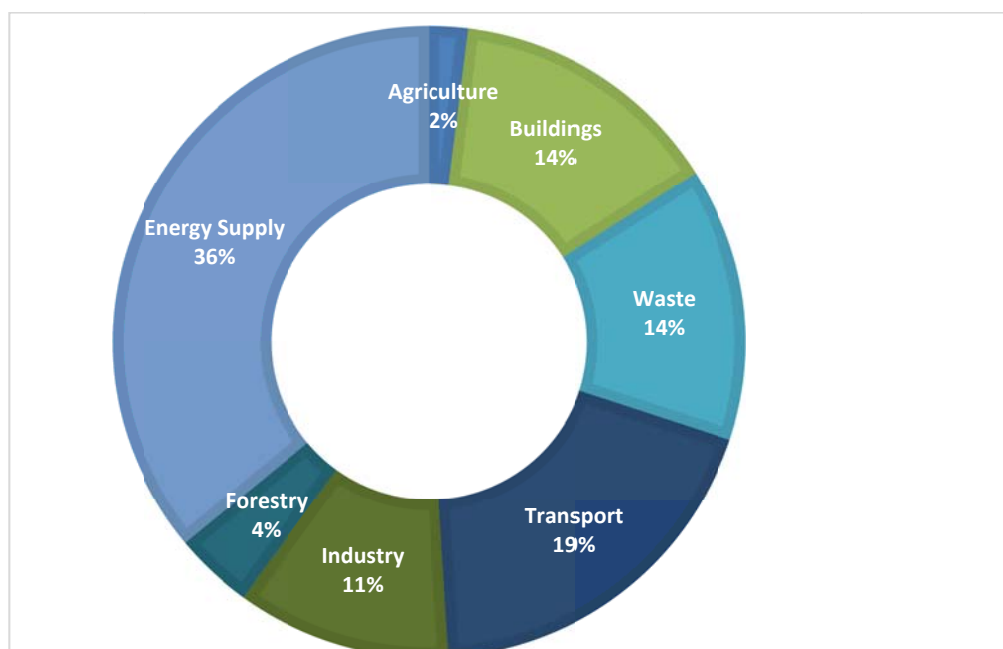
## 5 NAMA design outline

This chapter outlines the initial NAMA design. The following topics will be addressed:

1. Overview of NAMAs in building sector globally.
2. Overview of previous and ongoing activities in Armenia, on which this NAMA will build.
3. Starting points and selection of the sector/focus of the NAMA.
4. Objectives of the NAMA.
5. NAMA design and components.

### 5.1. Experience NAMAs in the building sector globally

A brief evaluation was made of the NAMAs being prepared/development globally in the building sector. Only few NAMAs are currently being developed in this sector. They differ strongly in scope and activities.



**Figure 7: Sectoral distribution of NAMAs**<sup>20</sup>

Examples are given below:

1. A Mexican NAMA for sustainable housing (10 year duration, including implementation of pilot projects).
2. A NAMA on energy efficient urban housing in Costa Rica requires USD 80 million, of which 73 million international support (over 10 year period). The largest share is needed for a large pilot construction project (1000 units).
3. A NAMA in Serbia addresses the financing of the refurbishment of 23 schools and 26 hospitals, without accompanying technical support.

<sup>20</sup> <http://www.nama-database.org/>

4. Tunisia NAMA for energy conservation (energy efficiency and renewable energy) in the building sector. The NAMA will comprise a program of activities and measures to address key barriers (financial, technology, knowledge barriers) to the implementation measures in the building sector.<sup>21</sup>

In conclusion, the Mexican NAMA for sustainable housing<sup>22</sup> may be the closest to NAMA concept for Armenia and serve as an example in design and budgeting.

## **5.2. Previous and ongoing activities promoting energy efficiency in buildings in Armenia**

Previous programs promoting energy efficiency in buildings have prepared the essential ground work and basic conditions, such as preparing regulation, initial awareness raising, and providing evidence of the potential and feasibility of energy efficiency in Armenian circumstances. This NAMA will now follow-up by supporting the actual implementation, e.g. by strengthening enforcement of norms, and by supporting actual energy efficient construction.

In particular, this NAMA proposal builds on the following previous activities:

- With support by UNDP, the Ministry of Nature Protection is building capacity on low carbon development and NAMAs in Armenia. In addition, GIZ may support establishing a NAMA conceptual framework (and selected NAMA proposals additional to this NAMA) for 2015.
- The UNDP-GEF project on Improvement of Energy Efficiency in Buildings supports development of building codes with energy efficiency requirements; control, testing and certification of energy efficiency of materials; awareness raising and piloting of integrated building design. Incremental energy efficiency measures were funded for a social residential building construction in Goris and Akhuryan towns. This project will continue until 2015.
- The Armenia Renewable Resources and Energy Efficiency Fund (R2E2), supported by WB/GEF, assists the energy efficiency refurbishment in public buildings.
- The European Commission INOGATE Energy Saving in Building Initiative (ESIB) focused on capacity building energy efficiency in housing sector. A case study was supported to apply integrated energy efficient design in new social housing construction (under a PPP model).
- The IFC Sustainable Energy Finance Project supports establishment of a sustainable market for energy efficiency and renewable energy investments. For energy efficiency, IFC project primarily supports financial institutions to develop energy efficiency lending and awareness raising on sustainable energy finance.
- The Armenia Sustainable Energy Financing Facility (ArmSEFF) of EBRD supported private enterprises access to energy efficiency investment funds through line of credit to local commercial banks. This credit line is now part of a regional credit line covering also Georgia and Azerbaijan (CEEP). However, very few loans have been issued for the residential sector, so far.
- The Commercialization of Energy Efficiency Project, financed by USAID, supports the private sector energy service companies and the banking sector to increase the availability of bank financing for energy efficiency projects.
- ASBA (National Social Housing Association) is developing a portfolio of affordable and energy efficient housing stock throughout the country for low/middle income groups with public support. The project is under construction in Dilijan city. A PPP model is used. Also, MUD has to further explore the modalities for PPP in social housing in Yerevan city by supporting a PPP pilot project.

The NAMA will promote establishment of the civil investment revolving fund being formed through environmental fees by applying a mechanism similar to the one used for “Green investments scheme”.

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<sup>21</sup> [www.mitigationmomentum.org](http://www.mitigationmomentum.org)

<sup>22</sup> See more on the Implementation of a New Social Housing NAMA in Mexico at <http://nama-facility.org/projects/projects-under-implementation.html>

### 5.3. Starting points and selection sector for the NAMA

#### 5.3.1. Starting points for the NAMA scope and design

The NAMA is designed on the basis of the following starting points and assumptions:

- The NAMA is envisaged for international support. Currently Armenia does not have the adequate resources to fully implement and finance this NAMAs.
- Specific mitigation actions will be included with clearly defined goals/objectives. The NAMA should address all relevant barriers on the different levels (policy, regulation, market barriers).
- The NAMA is limited to sector/sub-sector and specific technologies and sources of emissions, but on a national scope.
- The direct and indirect impact of the NAMA should be substantial in relation to the total emissions of the sector concerned and will have long lasting impact.
- Previous technical assistance programs promoting energy efficiency in buildings have prepared the essential ground work and basic conditions, such as preparing regulation, initial awareness raising, and providing evidence of the potential and feasibility of energy efficiency in Armenian circumstances. This NAMA will now follow-up by supporting the actual implementation, e.g. by strengthening enforcement of norms, and by supporting actual energy efficient construction/reconstruction.

#### 5.3.2. Sector scope

We distinguish between the direct and indirect scope of the NAMA:

##### Direct scope:

New construction and capital renovation, as well as maintenance/management/use of buildings supported by public means and/or owned and managed by public institutions. Public means includes: state budget, IFI loans/grants, municipal budget, public foundations and public-private partnerships (PPP). Both public buildings and social housing are included.

##### Indirect sector scope:

Indirectly, the NAMA will also promote energy efficiency in new commercial/private development/construction of residential stock, as well as renovation of existing housing stock, through some of the NAMA activities. The same applies to commercially/privately developed commercial building stock (e.g. commercial office buildings).

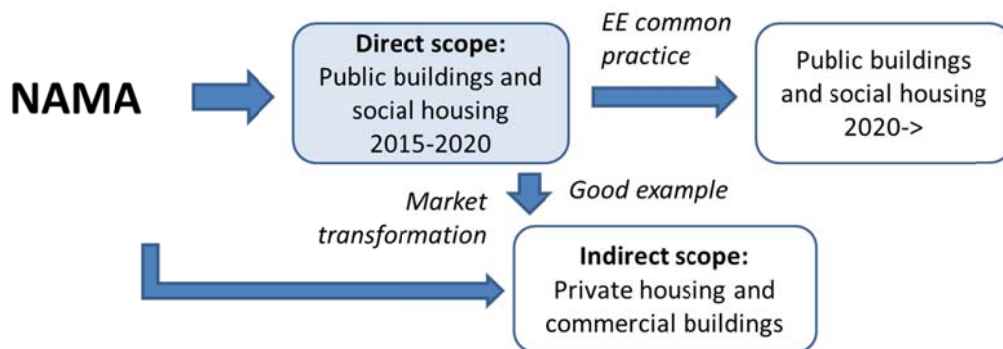


Figure 8: Direct and indirect scope of the NAMA



### **Technologies and energy efficiency practices to be promoted**

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

### **Rationale for selecting the public funded building sector**

- Public buildings and social housing is (partly) under governmental control (because (co-)financed) and often under public ownership and management, while the Ministry of Urban Development is the lead state agency in the field of housing construction and urban development. In that case, energy efficiency measures will be easier to implement.
- The public sector could set as a good example, in line with the EU energy efficiency policies.
- Energy efficiency would free up the scarce public budgets for this sector. Without energy efficiency, the expected increase of energy prices will increase the demand for public budgets.
- Within the overall framework of the national energy security and growing energy prices, and constrained budget resources in public buildings, energy efficiency is the shortest, cheapest way to help reduce country's energy import dependence, curtail the energy expenditures of public budgets, while mitigating climate change.
- Finally, addressing this sector could secure the necessary market transformation, which will have an indirect impact on private buildings (housing and commercial buildings) as well.
- While many credit lines and financing schemes have been established for leveraging financing for energy efficiency in many other sectors, including existing household apartments, however, (re)construction and management of public buildings and social housing remains a significant untapped sector for energy efficiency benefits.

## **5.4. Objectives of the NAMA**

Considering the potential benefits that energy efficiency investments may bring to the economic, social and environmental performance of buildings, the resulting energy security benefits and improved quality of many social/public services, the proposed NAMA will aim at accomplishing the following objectives:

- To increase the availability of finance for investments in energy efficiency in public building and social housing.
- Support the policy, regulatory, institutional, and market transformation leading to a structural higher level of energy efficiency and decreased GHG emissions from the building sector.
- Contribute to improved energy performance of public buildings in health, educational, cultural and other sectors, improving comfort levels, cutting public budget allocations for energy bills, while improving the overall quality of public services.
- Support the provision of adequate and affordable housing in Armenia by reducing the total costs for construction and operation, decreasing public costs and costs for the user/clients.
- Contribute to development objectives of Armenia (environment, economic, and social), related to the construction and building sector.
- Support transformational change to a low-emission development in a longer term.
- Contribute to improving energy security of the country.

### **Social inclusion, poverty alleviation and gender aspects**

Improving energy efficiency of social housing and reducing the costs for public buildings will support Armenia's social housing strategy. The strategy aims to provide vulnerable and low-income groups with adequate housing. This is a precondition for social inclusion. Also, the Armenian construction sector could provide additional employment. The NAMA will support local suppliers of energy efficient building materials. Gender aspects will be considered in further elaboration of the NAMA activities.

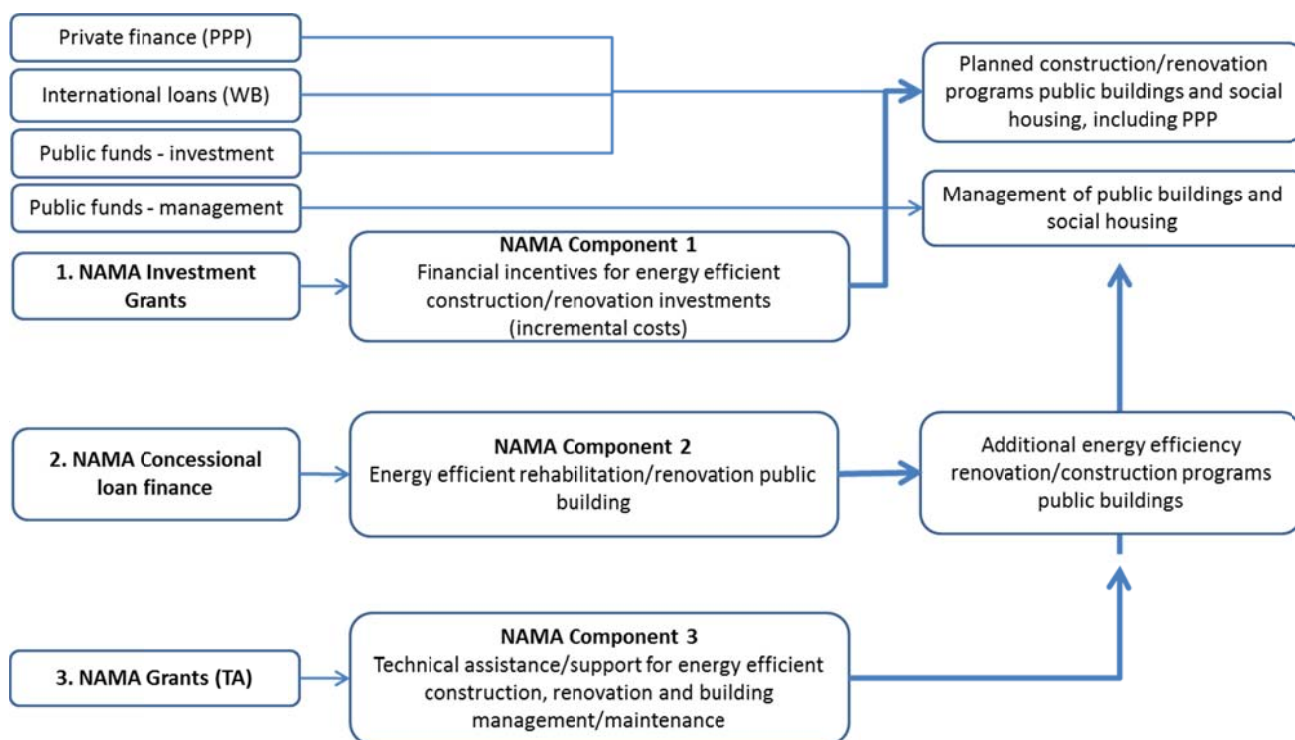
## **5.5. NAMA components**

### **5.5.1. Overview**

The NAMA will combine the following means of support:

1. Investment grants for co-financing of the incremental investment cost of energy efficiency measures in new construction and capital renovation of public buildings and social housing (Component 1)
2. Concessional finance for energy efficient capital renovation of public buildings (Component 2).
3. Technical support and assistance, supporting Component 1 and 2.

The NAMA program will address the main barriers and provide support to policy and strategies, regulatory framework, including enforcement, capacity and awareness, and financial barriers. Assuming international financing could be attracted, the activities will start in 2015. The NAMA first phase is planned for the period 2015-2020.



**Figure 9: Components of NAMA and financing/support**

The sections below outline the activities under these three components. They will be further elaborated on the basis of stakeholder consultations and discussions with international partners.

### **5.5.2. Component 1. Investment grants to cover (initial) incremental investment costs for energy efficiency**

In many cases incremental investment cost of energy efficiency measures incorporated in the building design will be paid back within a few years. Nevertheless, under current conditions in Armenia, the incremental costs to investments resulting from incorporation of energy efficiency measures/technologies are a significant barrier.

The co-financing of these incremental costs, could provide a necessary additional incentive supporting mainstreaming energy efficiency in building design and construction, and include in the reconstruction plans of public buildings and social housing. Indirectly, it will also be an incentive for those developers that act early. During the coming years, energy efficiency construction and maintenance will become increasingly common practice, diminishing the need for financial incentives.

#### **Incremental investment costs and potential for energy efficiency**

A Pacific Northwest National Laboratory (PNNL) study showed that internationally highly efficient buildings are cost-effective to build and operate. Incremental construction costs of about 1-7% easily paid back through annual energy savings of up to 50% and had average simple payback period of 6.8 years.<sup>23</sup> For Armenia the range is even broader. The benefits of energy efficiency in construction and possibility to minimize incremental costs are largely dependent on the quality and professionalism and ambitious targets set of integrated building design.

<sup>23</sup> Literature Review of Data on the Incremental Costs to Design and Build Low-Energy Buildings. W.D. Hunt. May 2008. Prepared for the U.S. Department of Energy Building Technology Program under Contract DE-AC05-76RL01830

## **Public buildings**

As to energy efficiency in building reconstruction, despite the higher cost (than in case of new construction) the growing energy prices have made these investments cost-effective. The GEF-funded program in Armenia targeted to building energy efficiency (R2E2's "Energy Efficiency Project" and "Improving Energy Efficiency in Buildings" UNDP/GEF project) have proven that energy efficiency investments with positive net present value and 7 years of simple payback can save over 50% of energy compared to baseline consumption both in residential and public buildings. R2E2 experience in public building energy efficiency retrofits firstly indicated that these buildings were in such poor state of maintenance and repair that would require substantial investments in rehabilitation without prospects for cost recovery. R2E2 estimated with incremental investments of about \$17-20 per m<sup>2</sup> (this is equivalent to approximately 10% of the common average \$200/m<sup>2</sup> for comprehensive building rehabilitation) the natural gas consumption for heating can be reduced twice, correspondingly the GHG emissions will be reduced by around 50%. The baseline heating energy demand of 120-125kWh/m<sup>2</sup>/year is ensuring only 40-50% comfort level, the EE measures allowed improving the comfort to acceptable levels within the existing budget constraints. These improvements are achieved by a comprehensive energy efficiency improvement package including insulation of walls/finishing, replacement of doors and windows, replacement of windows by walls, and roof insulation, after an efficient heating system has already been put in place. The R2E2 credit line has very strict eligibility criteria and can only finance energy efficiency measures which have attractive economic indicators (positive net present value) and only accept applications from public buildings where the comfort level is beyond 50%. As a result, the energy efficiency measures which may result in substantial greenhouse gas mitigation but has lower cost-effectiveness or is proposed for suppressed demand conditions will not be eligible for finance.

## **Residential buildings**

The residential buildings have a higher heat energy demand due to poor insulation and building aging. The results of documented and monitored pilot projects implemented by UNDP-GEF Building Energy Efficiency Improvement project estimated that the average heating energy demand in typical multi-apartment residential buildings is 185 kWh/m<sup>2</sup>/year and with cost-effective energy efficiency improvements the energy use can be cut by 38-40% and the demand can go down to 111 kWh/m<sup>2</sup>/year.<sup>24</sup>

On the other hand, the UNDP-GEF Project and USAID-funded Residential Energy Efficiency for Low-Income Households (REELIH) project has estimated that the cost of bringing thermal rehabilitation for an existing building will cost about \$40-45 per m<sup>2</sup>. Thus energy efficiency can comprise in average 20-25% of comprehensive building rehabilitation and repair expenditures. Despite the 58% energy saving and climate change mitigation potential, an average of \$200 million is being invested in public and social housing buildings without concern for energy efficiency due to legal gaps and poor enforcement, lack of awareness of the benefits of energy efficiency, limited technical and institutional capacity to pursue change, lack of incentives, etc.

The proposed NAMA activities will be aimed at eliminating the above barriers as well as introducing energy efficiency into the ongoing construction and reconstruction practices, as well as providing grant financing to support the incremental cost of energy efficiency investments. Since the enforcement of energy efficiency requirements in building codes has lagged for a long period of time, the knowledge and tradition of designing and building energy efficient buildings did not evolve. As the NAMA proposes to provide technical assistance for the capacity strengthening of the state policy enforcement in this field, this situation will change over the course of implementation and more solutions for lower incremental cost energy efficiency will be developed.

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<sup>24</sup> <http://erc.undp.org/evaluationadmin/manageevaluation/viewevaluationdetail.html?evalid=6782>

This is particularly important since the energy prices will continue to rise, while the seismic safety standards have been revisited and a large state campaign is underway to reinforce the existing buildings in priority order. The primary priority for building reinforcement financed by public funds could be schools and other places of mass gathering, but still needs to be decided.<sup>25</sup> This sector, where the state (presumably through the MUD PIU) will be investing in public building reconstruction, it will be cost-beneficial if these investments are also combined with adequate energy efficiency solutions.

### **5.5.3. Component 2: New investment program for energy efficient new construction and rehabilitation of public buildings**

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

The size of this NAMA component in terms of volume of concessional finance strongly depends on the availability and interest of international financial institutions, and cannot be quantified exactly at this stage of NAMA development.<sup>26</sup> Tentatively, the volume could be USD 10-30 million to be substantial to meet the demand.

### **5.5.4. Component 3: Technical support and capacity building**

This component will support the implementation of NAMA component 1 and 2 securing the efficiency and effectiveness of climate finance and financial incentives for energy efficiency. This includes:

- Strengthening/enforcement of inspection of construction (including training for state inspectors and construction quality control organizations/experts)
- Training on energy efficient design and design evaluation (including for designers/architects). This includes involving future users of the buildings in the design process.
- Training on maintenance/operation of public buildings and social housing. Specific attention will be given to improving the management/maintenance of buildings through introduction of the energy audit practices.
- Measuring, reporting and verification: This includes establishing protocols and building national capacity for measuring, reporting and verification of energy use/savings.
- Implementation of energy efficiency procurement regulation and guidelines.
- Measuring, reporting and verification of energy use/savings.
- Improving the statistics on the public building stock to include: basic characteristics, typology and use, energy use and costs, as well as energy efficiency potential. This will support the future planning of rehabilitation programs.
- Outreach and awareness raising.

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<sup>25</sup> The Ministry of Urban Development and the Ministry of Finance of the Republic of Armenia are negotiating with KfW the possibility of accepting a concessional loan with 15 years of repayment period with up to 2.5 % of annual interest rate for energy efficiency in school buildings. The MUD stated preference is that the energy efficiency investments are combined with seismic reconstruction and rehabilitation throughout Yerevan and regions of Armenia. The minimal KfW loan size is usually not less than \$10 million. Source: website MUD

<sup>26</sup> A new KfW loan for energy efficient renovation for schools under discussion could be considered under this NAMA, as the objectives of the loan and of NAMA are quite similar.

## 6 Stakeholders and institutional framework for implementation

### 6.1. Overview of main stakeholders

#### Ministry of Urban Development (MUD)

The MUD is responsible for construction and building policies and regulation, and for overseeing most of the investments in this sector. MUD is also responsible for the Social Housing Strategy. The energy efficiency related tasks/functions are included in its Charter. MUD has three separated units that have key role in urban development sector.

- The Urban Development Project Implementation Unit is in charge of implementing of client functions for urban development programs through state budget means of the RoA in cases defined by legislation of the RoA.
- The Urban Development Inspectorate is responsible for enforcement of building norms/standards.
- The "Licensing Centre" agency is responsible for issuing licenses for urban development sector organizations and specialists.

The provisions for energy efficiency and energy saving regulation in the construction sector were added in MUD Charter by the decision N225-N of the Government of the RoA dated March 14, 2013<sup>27</sup>. According to the Ministry of Urban Development action plan for 2014 the decision “On application of measures directed towards increasing of energy saving and energy efficiency in objects constructed by the state means” is already being drafted for adoption by the RoA Government.

#### Ministry of Nature Protection (MNP)

MNP is the authorised national entity for coordination of the UNFCCC implementation. The Ministry of Nature Protection of the Republic of Armenia is leading on dealing with climate change and development of the concept of NAMA in the Republic of Armenia. The Climate Change Information Centre supported by UNDP is assisting the Ministry in climate change related activities.

#### Other Ministries

Ministry of Labour and Social Affairs manages social housings: centres for the elderly, boarding schools, as well social housing through the State non-commercial organization SNCO “Service Center for Social Housing Stock”.

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<sup>27</sup> Among urban development policy directions of the RoA, the Ministry is tasked with:

(5) establishing the principle of "green urban development", ensuring the harmonious, mutually complementary development of natural and cultural landscapes;

(5.1) promoting the planning and construction of energy-saving and energy-efficient buildings and urban development systems, ensuring the elaboration of the legislation required therefor;

The ministry carries out the following functions for implementation of its goals and tasks:

(8) elaborate territorial development programmes aimed at improving the ecology of cities and reducing the negative effects of urbanisation on the environment, as well as raising the level of adaptability to climate changes;

(8.1) undertake and implement measures aimed at improving the legislation relating to energy saving and energy efficiency in the field of urban development, drawing up regulatory technical documents and bringing them in compliance with the new European and international standards;

(8.2) develop and coordinate programmes aimed at raising the level of energy saving and energy efficiency of buildings, cooperate with relevant international organisations within the scope of the mentioned tasks, ensure the provision of information on energy-saving technologies.

### **PIUs and municipalities**

- Investments in the construction sector are implemented through different PIUs (health, education), municipalities (including Yerevan), and other public institutions (including the Armenian Social Investment Fund, All-Armenian Fund). These institutions will play a key role (as implementing partners and beneficiaries).

### **Armenia Renewable Resources and Energy Efficiency Fund (R2E2) <sup>28</sup>**

- The main objectives of the Fund are to facilitate investments in energy efficiency and renewable energy sectors and promote the development of EE and RE markets in Armenia. This includes supporting energy efficient rehabilitation and management of public buildings (including schools, hospitals, and kindergartens).

### **Other national stakeholders and beneficiaries**

- The NAMA will involve/address/support the main actors: policy makers, regulators, sponsors, developers, architects, designers, contractors, suppliers/manufacturers, financial institutions, inspectors, auditors, maintenance, and clients/users of the building.

### **International financial institutions**

- Renovation and new construction in the public sector is largely financed by the World Bank (through different PIUs and R2E2 Fund).
- KfW is discussing with Ministry of Finance and MUD a loan for energy efficiency renovation of schools.
- Other FIs (EBRD, AFD, IFC, GGF) are implementing or planning credit facilities for the residential sector, predominantly through participating banks / credit institutions and offering energy efficiency loans for household energy efficiency retrofits, however none of them offer residential EE financing for building-level solutions.

### **UNDP**

- The NAMA focuses on implementation of energy efficiency in buildings and, as such, builds on the results of previous UNDP activities in promoting energy efficiency, such as the “Removing barriers for energy efficiency in heating sector”, “Improving energy efficiency in buildings”, “Green urban lighting” UNDP-GEF projects. These projects have prepared the ground by providing essential elements, including the corresponding upgrade of national regulations/norms in construction sector.
- The development of this NAMA proposal is supported by UNDP, which is committed to support further the implementation of the NAMA in a capacity of an implementing agency for technical assistance component.

## **6.2. Organization/institutional framework of the NAMA**

This section outlines a proposal for the organization set-up for management and operation of the NAMA. Two levels can be distinguished:

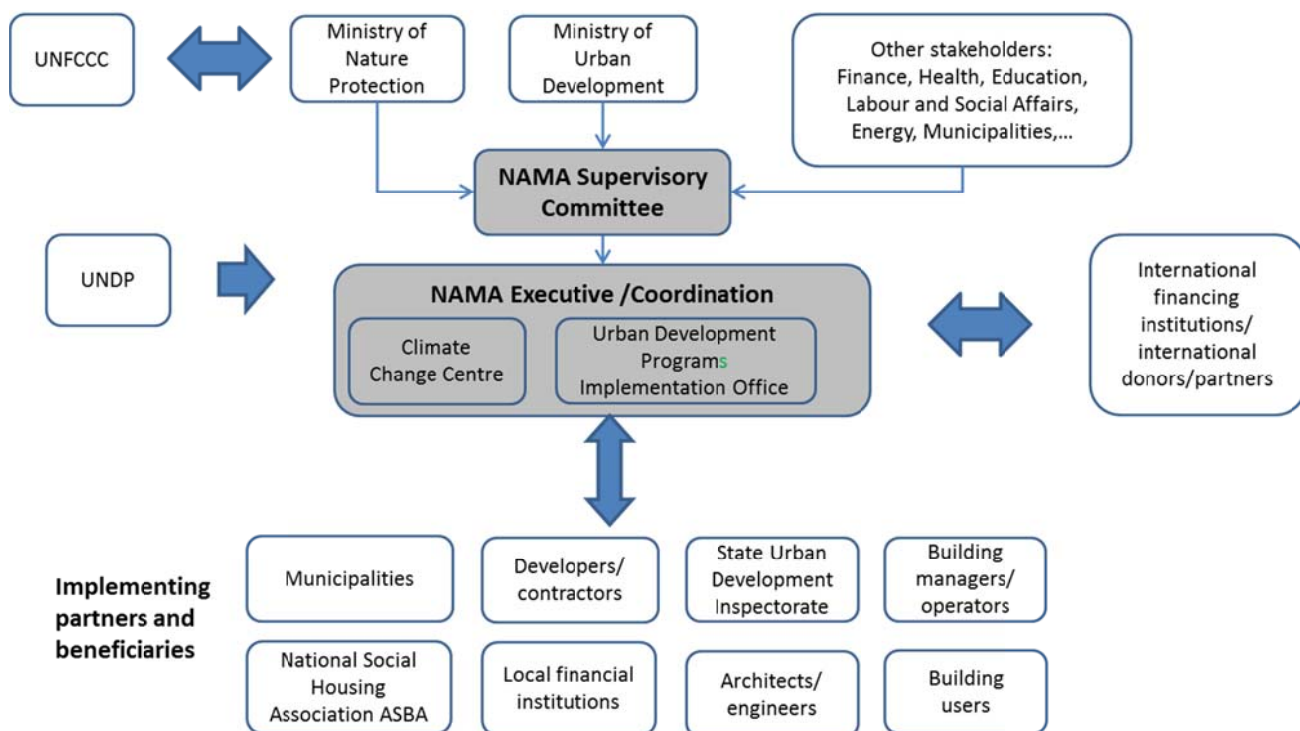
- Supervisory: responsible for the NAMA strategy, overall responsibility of NAMA implementation, and its monitoring and evaluation, information sharing with public.
- Executive:
  - o responsible for operational management
  - o provision of technical assistance and preparing MRV reports.

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<sup>28</sup> [www.r2.e2.am](http://www.r2.e2.am)

It is proposed that MUD takes the lead in developing and implementing this NAMA, potentially through the Urban Development Projects Implementation Unit. This could be done in close cooperation with the Ministry of Nature Protection (MNP) and the Climate Change Information Center of MNP responsible for technical assistance and MRV.

The Climate Change Information Centre has extensive experience in management of climate change and energy efficiency programs, similar to the activities to the proposed NAMAs. Also, its involvement secures the continuity from the UNDP-GEF project “Improving Energy Efficiency in Buildings” finalising in mid-2015.



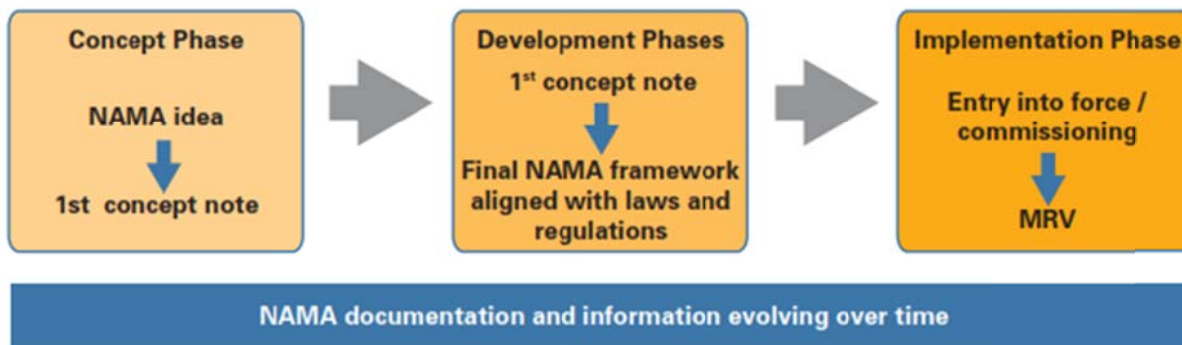
**Figure 10: Proposed organization of the NAMA**



## 7 Time frame for preparation and implementation

### 7.1. Preparation of the NAMA framework and this NAMA

The graph shows the simplified NAMA life cycle.



Source: Perspectives Climate Change (2013)

Figure 11: NAMA development cycle

This document presents the initial NAMA concept. As this is the 1<sup>st</sup> NAMA to be initiated in Armenia, the overall NAMA framework still needs to be developed also. It is the intention to also develop other NAMAs in other sectors as well, as specified in Armenia's association to the Copenhagen Accords.

### 7.2. Implementation

#### Phasing

The duration and scheduling of the NAMA program will match the relevant budget/investment cycles, and programming/planning cycles. To achieve a significant impact, a certain duration is necessary. Time scheduling of NAMA implementation is to be synchronized with public budget planning and design phase of major construction/reconstruction efforts. Four year duration for 2015-2020 is assumed as first period.

#### Interim evaluation and redesign

After two years, the NAMA will be evaluated. This included the uptake of the activities and incentives, and the impacts. Also, the changes in market conditions will be monitored. The results of the evaluation may lead to the redesign of the NAMA activities, in particular the conditions for financial incentives and the energy efficiency standards applied.

### 7.3. Risks and risk mitigation

The following risks are identified for the preparation and implementation of the proposed NAMA:

- Lack of local ownership. To secure ownership, the key stakeholders have been involved in the preparation of the NAMA at an early stage, in particular MUD. Also, the NAMA activities are aligned closely with the current responsibilities and programs of the key stakeholders.
- Lack of financing and international contribution. The availability of climate finance, in particularly for NAMA support, is still limited. It remains uncertain if and when international support could be secured for this NAMA. It is important that the NAM concept is widely published and promoted, and that initial discussion with potential donors and financiers are held a.s.a.p.

## 8 Costs, financing and other support needs

### 8.1. Introduction and references

The budgets for implementation of the NAMAs, currently being prepared globally, and the requested contribution of international support show a very wide range. The budgets depend on design, scope, ambition and time frame of the NAMA. The level of local contribution versus requested international support also strongly varies.

Some examples are given below:<sup>29</sup>

- A Mexican NAMA for sustainable housing requires USD 15 million for implementation (10 year duration, including construction of pilot projects).
- A NAMA on energy efficient urban housing in Costa Rica requires USD 80 million, of which 73 million international support (over 10 year period). The largest share is needed for a large pilot construction project (1000 units).
- A NAMA in Serbia includes the refurbishment of 23 schools and 26 hospitals. Total budget € 12.5 million.

### 8.2. NAMA costs and budget

#### 8.2.1. Costs and support for the preparation of the NAMA (2014/2015)<sup>30</sup>

The support provided to the further preparation of this proposed NAMA should not only address the needs of the specific NAMA but also support developing an overall NAMA framework in Armenia, paving the way for future NAMAs in other sectors. Overall barriers for NAMA implementation, challenges and gaps in Armenia may include:<sup>31</sup>

- Setting baselines and targets.
- Evaluation of the GHG emission potential and opportunities in line with housing sector policies.
- Establishing the MRV system.
- Lack of public and private financing for housing investments.
- Lacking capacity to attract carbon financing.
- Implementation and enforcement of energy efficiency policies, including regulation, in the housing sector is still at an early stage.
- Low awareness on NAMAs among key financial institutions operating in Armenia, and on ways of realisation of the opportunities existing under UNFCCC processes.

#### 8.2.2. Costs for implementation of the NAMA (2015-2020)

A tentative budget is shown below . This includes costs directly related to the NAMA activities only and is based on the activities described in this draft project document. The budget will be revised on the basis of further discussion on the NAMA program with partners and stakeholders.

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<sup>29</sup> <http://www.nama-database.org/>

<sup>30</sup> GIZ may support developing the NAMA framework in Armenia, as well as developing other NAMAs in parallel. This NAMA will also benefit from this support.

<sup>31</sup> July 2012, the Secretariat of the UNFCCC in cooperation with the RA Ministry of Nature Protection organized a workshop focused on NAMAs in Asia Pacific region

**Table 1: Tentative budget for the proposed NAMA (2015-2020)**

NAMA component	Budget (USD)	Notes
<b>Component 1. Financial incentives to cover incremental costs energy efficiency in planned investment programs</b>	2-4 million	Investment grants, complementing public investments for new construction and renovation
<b>Component 2. New energy efficiency rehabilitation program public buildings</b>	10 – 30 million	Concessional loans
<b>Component 3. Technical assistance/support for component 2 and 3 including strengthening building management</b>	1-2 million	Grants

### 8.3. Financing

The possible sources of NAMA finance include state and local public budgets, private sector contribution, and international public support for NAMA (grant, concessional finance). Innovative sector-level NAMAs are already being supported by international financial institutions and multilateral development banks, as well as by the EU. The Green Climate Fund will become operational soon, and is likely to support NAMA implementation.

In Armenia, there is limited knowledge of international climate finance opportunities and requirements for effective identification and formulation of attractive projects. Also, the capacities for formulation and utilization of the international public and private financing opportunities for this sector are limited.

The initial discussion with potential donors and financiers should start a.s.a.p. on the basis of this NAMA concept and on the basis of its registration at the UNFCCC.<sup>32</sup>

<sup>32</sup> The development of an overall NAMA framework in Armenia, potentially supported by GIZ, could also address marketing and financing of NAMAs.

## 9 MRV and impact evaluation on GHG emissions

This section discusses the methodology and institutional framework for measuring, reporting, and verification (MRV) of the NAMA impact on climate mitigation and GHG emissions. The framework for MRV of the impact on sustainable development objectives, other than climate change mitigation, is discussed in the next chapter. The full MRV framework will be developed at a later stage on the basis of the final NAMA design.

For the purpose of this initial NAMA proposal, a tentative quantitative assessment has been made of the NAMA impact.

### 9.1. MRV framework for GHG emissions

During the MRV design process, it should be decided what to measure, how to measure, when to measure and who should measure.

#### 9.1.1. Direct versus indirect impact

The MRV methodology should address the two levels of impact and require a differentiated approach

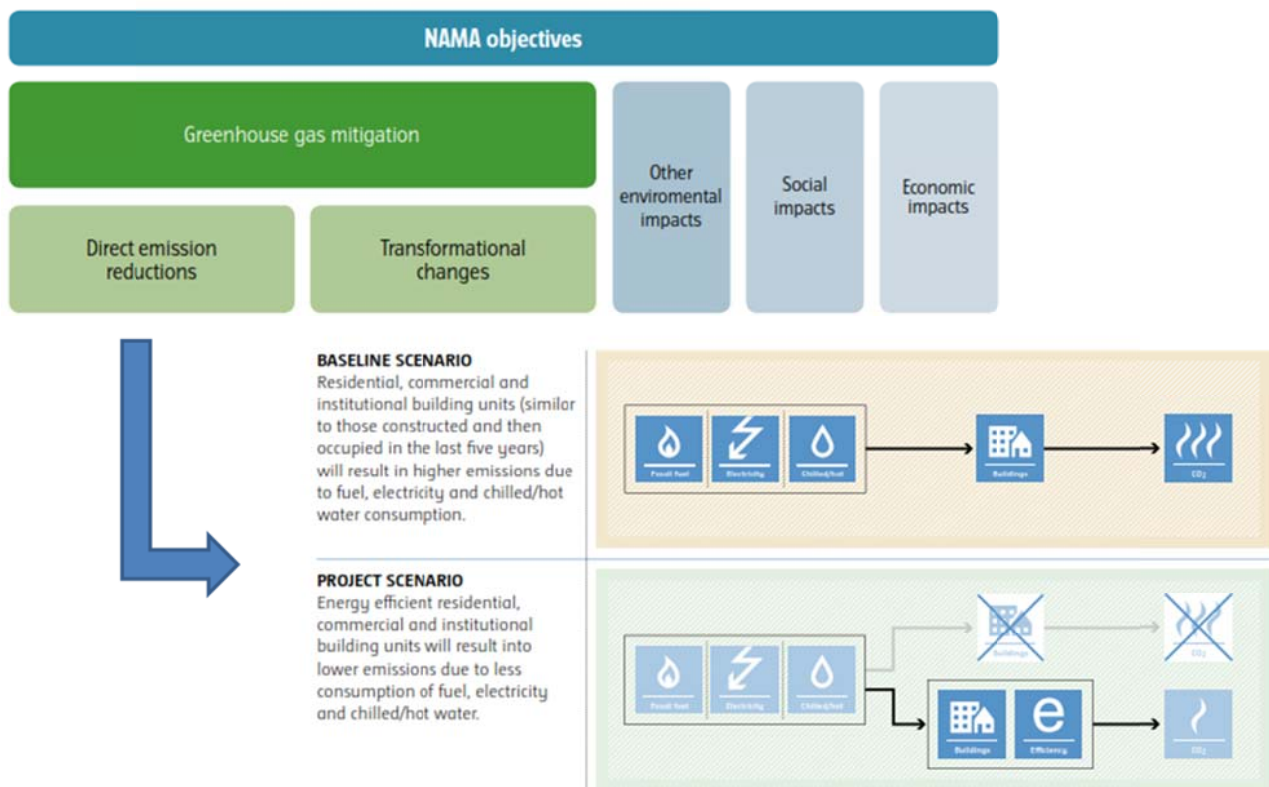
1. Direct impact: GHG emission reduction in new construction/renovation/management in public buildings and housing supported by public means (direct NAMA scope). This includes promoting energy efficiency in planned investment programs as well as in new investment programs.
2. Indirect impact: scaling-up potential on all construction and housing sector (commercial and private new construction and renovation in housing; commercial/private buildings) through the following NAMA activities:
  - Improved enforcement on construction norms with impact on energy efficiency
  - Improved enforcement of legal – regulatory provisions on energy efficiency;
  - Information and awareness campaigns
  - Market transformation (supply and demand for energy technology, practices, services)

For the indirect impacts, the causality between the activity and the impact will often be difficult to establish. This is the case of capacity building activities aiming at transformational changes. These activities are difficult to associate with emission reductions or other sustainable development benefits although they enable long term mitigation impacts through removing barriers (e.g. regulatory changes, strengthening of enforcement capacities, etc.). This is also the case for other types of enabling activities.

A top-down MRV approach to mitigation impacts of several activities may therefore be more suitable to understand causality than a bottom-up MRV approach applied at the activity level. The methodology is not further elaborated in this NAMA concept. In the section below, the methodology for MRV of direct impacts will be further discussed.

#### 9.1.2. Methodology for direct impact

The graph illustrates the methodological approach to MRV of the direct impact



**Figure 12: Approach to MRV of climate mitigation and SD impact** <sup>33</sup>

The methodology for MRV could be based on the following principles

**Activities**

The actual level as basis for MRV is defined to be the floorage of those buildings that fall with the direct scope of the NAMA, are addressed by the NAMA activities, and that are newly constructed/renovated or which management is improved.

**Baseline for energy use and GHG emissions**

A baseline is a level of emissions that provides a reference level to establish a goal or target and/or to measure progress. What would the level of energy efficiency and corresponding specific use of energy of buildings without the implantation of the NAMAs?

The baseline could be based on current common practice, having as indicator the historical specific energy demand in buildings in the same sector, the same use, and of the same typology in the last couple of years.

The following baseline parameters need to be collected/assessed:

- Specific final energy demand for heating energy (natural gas and electricity<sup>34</sup>) and hot water use in the main building types in the NAMA’s scope, average over the last couple of years. This data could be derived from different sources, a.o.:
  - o Energy statistics, including the national Energy Balance. <sup>35</sup>
  - o Monitoring data of R2E2 and UNDP-GEF demonstration projects.
  - o Ex-post audits and monitoring of energy use results for specific buildings.

<sup>33</sup> Sources Mitigation Momentum (2013) and UNFCCC. CDM Methodology Booklet (2013)

<sup>34</sup> Natural gas and electricity are the main final energy carriers for buildings in Armenia.

<sup>35</sup> For example, an ongoing project (supported by USAID) aims to improving of energy statistics and develop Energy Balance of Armenia for 2010 and capacity building for continues actions.

- Ex-ante evaluations of expected energy use.

To calculate GHG emissions from final energy demand the following parameters can be used:

- Carbon emission factor (CEF) of national power grid and GHG emissions from natural gas based heating systems. The CEF values for Armenia have been published for use in CDM and could also be used for NAMAs.

### Energy use and GHG emission of energy efficient (NAMA) buildings

The impact of the NAMA results in the implementation of energy efficiency technologies and practices in construction, renovation and management. This will be reflected in the specific final energy use of building compared to the baseline. The data could be derived in the following ways, a.o.:

- For a specific building: ex-ante evaluation on basis of the design, and/or ex-post monitoring of building performance,
- For a specific type of buildings, data from reference buildings.

The overall methodology is summarised in simplified way in the Table 2 below. Final energy reduction is assessed per annum.

**Table 2. Indicative table for assessing annual final energy saving and associated HG emission reduction by building category**

Building category	Building	Area per building	Baseline, specific final energy use (gas and electricity)	Realized specific final energy use (after energy efficiency measures)	Reduction of final energy use on building level (gas and electricity)	GHG emission reduction (applying specific emission factors)
<b>A</b>	1					
	2					
<b>B</b>	1					
	2					
	..					
<b>Total annual final energy reduction (gas/electricity) and GHG emission reduction</b>					+	+

## 9.2. MRV institutional arrangements and process

The previous section outlines the methodology for MRV. The 2<sup>nd</sup> component of the MRV system is the organization of MRV, including the institutional arrangements and responsibilities.

**Table 3. Institutional requirements for MRV system**<sup>36</sup>

MRV Elements Block	International Supported NAMAs	For this specific NAMA
<b>Scope of NAMA</b>	Activity which impacts emissions of one of the GHG gases	See NAMA concept
<b>Program oversight</b>	Multilateral or bilateral agreement using national legislation of cooperating Parties	NAMA supervisory committee. Involved international partner and type of agreement with GoA to be discussed.
<b>Issuance/compliance body</b>	Government body authorised for the multilateral agreement	MUD
<b>Standards</b>	Bilateral Standards (no international regulation)	To be developed for this NAMA. In any case all national standards
<b>MRV Control Entity &amp; Qualifications</b>	Third party or government body	To be discussed whether third party verification is necessary in addition to internal MRV
<b>Monitoring &amp; Reporting (level of buildings)</b>	Results are available to oversight and participants only	For each new constructed/renovated building, a monitoring and reporting reports is drafted. Ex-post monitoring.
<b>MRV Reporting (National Level)</b>	Publically or internally available	Aggregated building-level reports MRV reports to be published annually. Prepared by NAMA executive body.

### 9.3. Evaluation results of NAMA impacts (GHG mitigation)

#### 9.3.1. Introduction

This section reports on the initial ex-ante evaluation of the impacts on the NAMA on GHG emissions. The evaluation is based on the MRV methodology presented in the previous section. In this initial evaluation, within the scope of preparation of this NAMA concept, simplified assumptions are made.

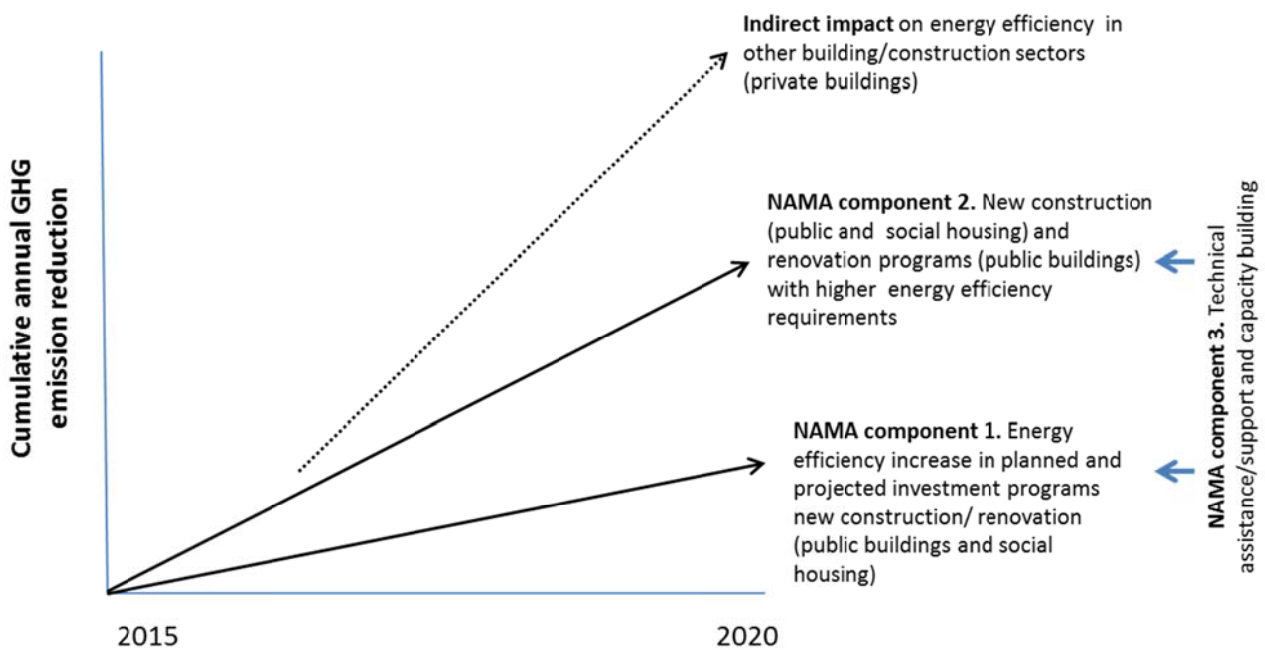
The graph below illustrates the impact categories of the NAMA. Three categories are distinguished:

- The impact of the 1<sup>st</sup> NAMA component: increased energy efficiency in new constructed and renovated public buildings and social housing under planned investment programs.
- The impact of the 2<sup>nd</sup> component: new construction/renovation programs implemented through involved concessional loans subject to higher energy efficiency requirements.
- Finally, the indirect impact of the NAMA on other buildings sectors (private building) outside the direct scope of the NAMA.

NAMA component 3 (technical assistance/support and capacity buildings) will support component 1 and 2 and secure/strengthen their impact.

<sup>36</sup> On basis of DNV, 2013. [http://mitigationpartnership.net/sites/default/files/4.\\_dnv-\\_mrv\\_presentation.pdf](http://mitigationpartnership.net/sites/default/files/4._dnv-_mrv_presentation.pdf)





**Figure 13:** Direct and indirect impact categories of the proposed NAMA

### 9.3.2. NAMA impact in planned and projected public investment programs for new construction and renovation programs (NAMA component 1)

The following inputs and assumptions were used to calculate the impact on energy use and resulting energy savings for the building portfolio addressed by the NAMA Component 1.

- Final energy for space heating, hot water production, and cooling/ventilation is considered.
- The planned investment programs cover both new construction and renovation of buildings. The baseline for renovated buildings is the average specific energy use in existing buildings in Armenia. The baseline for new construction is the average specific energy use in new constructed building in recent years.
- The increased levels of energy efficiency (in terms of reduced specific final energy used) are based on the available experience and studies in Armenia (see section 5.5.2). The table below summarises the simplified assumptions:

The baseline situation in which the interventions are viewed has some noteworthy features presented below:

- While in the last decade the majority of buildings have made a transition to local gas-fired heating boilers (which are by now old, at 70% efficiency at most, and require an upgrade to at least 90% efficiency), there is still a significant share of electric heating. The experts estimate electric heating to cover about 30% of the normative heat demand in buildings, while the remaining 70% is fired by natural gas. The carbon footprint of direct gas-fired heating is certainly substantially lower than for electric heating which is associated with generation and transmission inefficiencies as well, hence the replacement of electric heating has a more beneficial in terms of climate change mitigation.
- Based on the findings from the R2E2-WB project, the multiple energy audits and pilot project monitoring results in public buildings have revealed a baseline normative heat demand of 200-310kWh/m<sup>2</sup> (depending on the climate zone), which was further reduced by 50% after capital energy efficiency retrofits to 100-150 kWh/m<sup>2</sup> per year. The social housing, in turn, registers a range of 220-260 kWh/m<sup>2</sup> in different climate zones in baseline situation, which after integration of energy efficiency measures in design or capital retrofitting can be brought down to 80-160kWh/m<sup>2</sup>. To aggregate the data



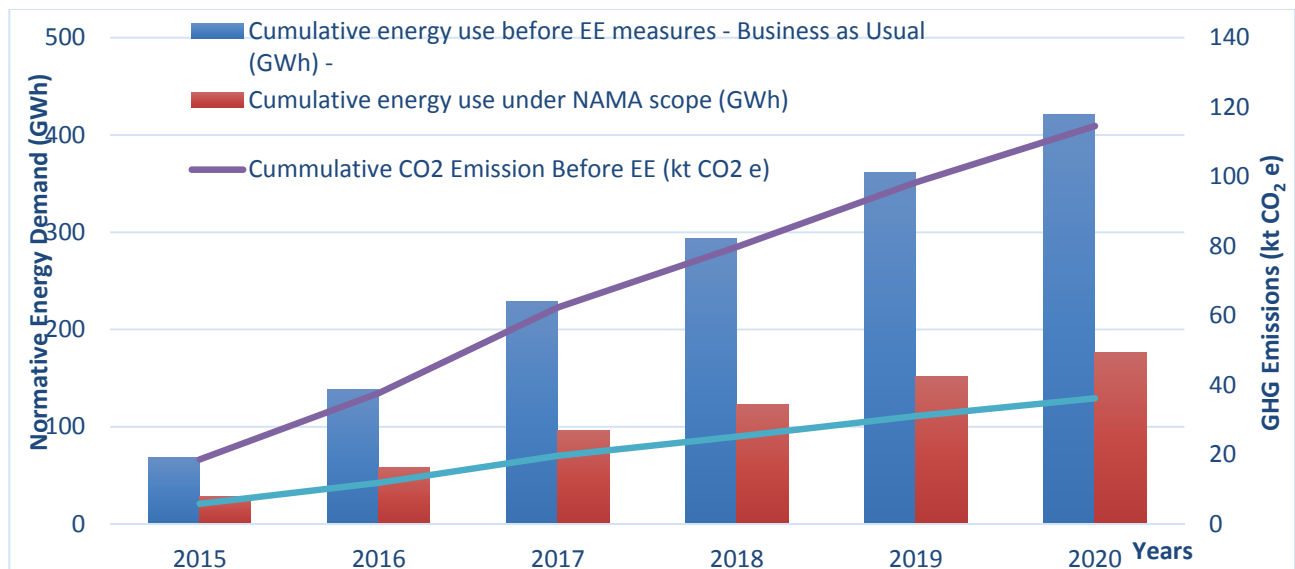
for all categories of buildings and all climate zones, the average indicators used were 250kWh/m<sup>2</sup> before energy efficiency measures (240 kWh/m<sup>2</sup> for gas-fired and 260kWh/m<sup>2</sup> for electric heating). Energy efficiency measures which bring those buildings in compliance with the requirements of the building energy codes on average result in reduced heating energy demand of 120kWh/m<sup>2</sup>year, thus leading to an average energy saving of 140kWh per square meter each year.

For the purposes of the present assessment the selected average indicators as summarized in the Table 4 below.

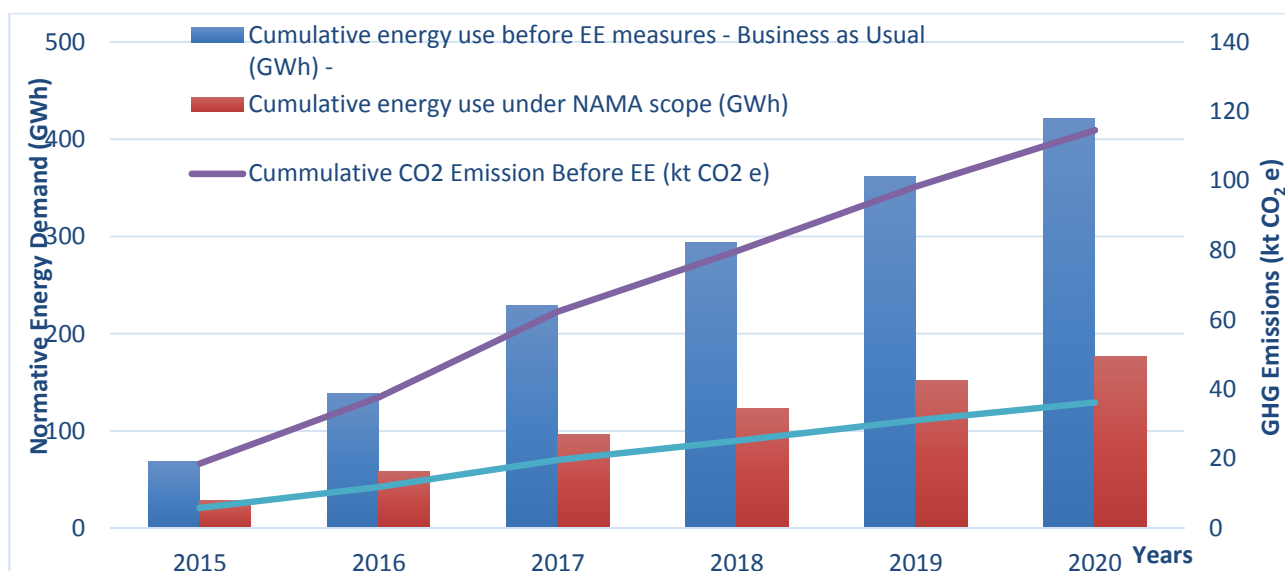
**Table 4. Normative Unit Heat Energy Demand Before and after Energy Efficiency Measures**

Type of Heating	Conversion Efficiency %	Energy output, kWh/m <sup>2</sup>	Energy input, kWh/m <sup>2</sup>	CO <sub>2</sub> , kg/kWh	CO <sub>2</sub> emission, kg/m <sup>2</sup>	CO <sub>2</sub> saving, kg/m <sup>2</sup>	Energy saving kWh/m <sup>2</sup>
<b>Before EE Measures</b>							
<b>Gas Boiler – Old</b>	70	240	343	0.205	70		
<b>Electric Heating</b>	100	260	260	0.428	111		
<b>After EE Measures</b>							
<b>Gas Boiler – New</b>	90	120	133	0.205	27	43	<b>210</b>
<b>Fuel switch from Electric Heating</b>	100	120	120		0	84	<b>140</b>
Weighted average energy performance for different heating sources: 70% natural gas and 30% electricity							
<b>Before EE Measures</b>		185	318	0.272	83		
<b>After EEM Measures</b>		111	133	0.205	27	55	<b>185</b>

Figure 14, in turn, depicts the business as usual and post-NAMA cumulative energy use within the buildings in the NAMA scope and the associated cumulative GHG emissions.



**Figure**



**Figure 14. Cumulative building energy performance baseline (business – as- usual) and after energy efficiency interventions (GWh) and CO<sub>2</sub> emissions in buildings covered by NAMA Component 1 (new construction and renovation) by 2020**

The impact on GHG emissions is calculated from the final energy savings as follows: for savings in electricity, a carbon emission factor for grid-based electricity use is 0.428 kg CO<sub>2</sub> per kWh.<sup>37</sup> For savings in case of natural gas-fired heating, a carbon factor of 0.205 kg per kWh was used, corrected for the efficiency of energy transformation technology. Based on the observed situation, about 30% of public buildings consume electricity prior to the energy efficiency retrofits. The capital renovation must address the heating technology in priority order, changing the electric driven heat-and-hot water demand to gas-fired alternative. In cases where old and inefficient gas boilers are in place (70% efficiency), these should be replaced with high-efficiency (90%) ones.

### 9.3.3. NAMA impact on new investment programs for new construction and renovation programs in public buildings (NAMA component 2)

The 2<sup>nd</sup> NAMA component will promote energy efficiency in new/additional renovation programs in public buildings, to be financed by concessional loans with special requirements for energy efficiency and /or new climate financing mechanisms.

The following inputs and assumptions were used to calculate the impact on energy use and resulting energy savings for the building portfolio addressed by the NAMA Component 2.

- The NAMA concept estimated volume of public buildings under this component is estimated according to the volume of buildings in the need for renovation. However this will strongly depend on available finance and additional analysis of the needs in the specific subsectors. For the purpose of this impact evaluation, it is assumed that USD 20 million is available to finance energy efficient renovation of schools, which is currently a priority of MUD.
- Final energy for space heating, hot water production, and cooling/ventilation is considered. The planned new investment programs can cover both new construction and renovation of buildings. The baseline for renovated buildings is the average specific energy use in existing buildings in Armenia. The baseline for

<sup>37</sup> Combined margin emission factor for Armenian energy grid for 2012 is 0,428 kg CO<sub>2</sub> per kWh.  
Source: Calculation of Grid Emission Factor for the Electricity System of the Republic of Armenia for 2012.  
www.nature-ic.am.

new construction is the average specific energy use in new constructed building in recent years. The increased levels of energy efficiency (in terms of reduced specific final energy used) are based on the available experience and studies in Armenia (see section 5.5.2).

- Based on the sample of schools that have undergone energy efficiency retrofitting within the existing R2E2 Building Energy Efficiency Program, the maximum investment for energy efficiency in public buildings was \$22/m<sup>2</sup> which allowed reaching 52-58% reduction of energy consumption. Considering that most public buildings require a substantial repair and refurbishing investments, as well as seismic reinforcement, which is a major priority for the MUD under the 2014 new Building Code on “Reconstruction, restoration and strengthening of buildings. Main provisions” of 24 March 2014 which requires upgrading the seismic resistance of any building (built before 1991) undergoing major reconstruction. This would mean that only a fraction of the available investments can be directed towards energy efficiency improvement measures, since all public building investments will now also need to include seismic reinforcement expenditures. With this regards, to evaluate the impact of Component 2 of the NAMA, the envisioned energy efficiency investments will presumably be at \$10 million, which would be sufficient to improve the energy performance of over 455 thousand m<sup>2</sup> (based on the \$22/m<sup>2</sup> cost estimate for EE investment assumption above). As the below Table 5 indicates, this volume would lead to almost 84 GWh energy saving per year.

**Table 5. Key Assumptions and Input Parameters for Component 2**

<b>Component 2</b>	<b>Investments</b>
<b>Total investment in Component 2 (EE and general refurbishment/reinforcement)</b>	\$ 20 000 000
<b>EE Investment (50% of total)</b>	\$ 10 000 000
<b>EE Investment per 1 m<sup>2</sup></b>	\$22
<b>Total EE retrofitted space (1000 m<sup>2</sup>)</b>	455
<b>Energy Saved (kWh per 1 m<sup>2</sup>)</b>	185
<b>CO<sub>2</sub> emission reduction (tCO<sub>2</sub>e/MWh)</b>	0.299

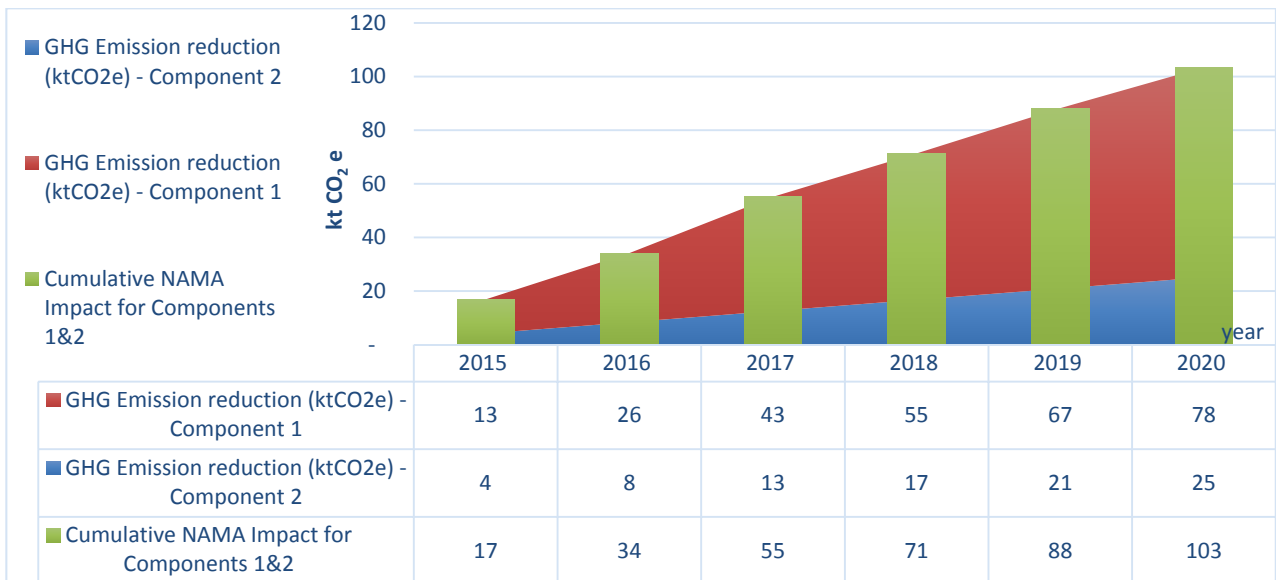
Assuming that the estimated area will be covered in equal fractions within the 6-year period during 2015-2020, and the investments will start generating savings and mitigation effect starting from the first year, the total saved energy will be equivalent to approximately 86GWh and reduce the GHG emissions by a cumulative amount of more than 25 ktCO<sub>2</sub>e (See Table 6).

**Table 6. Coverage, energy saving and GHG mitigation potential of NAMA Component 2\***

	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>Annual coverage (1000 m<sup>2</sup>)</b>	76	76	76	76	76	76
<b>Annual energy saving (GWh/year)</b>	14	14	14	14	14	14
<b>Cumulative Energy Saving (GWh)</b>	14	28	42	56	70	84
<b>Cumulative GHG Emission reduction (ktCO<sub>2</sub>e)</b>	4	8	13	17	21	25

\* - Final energy savings (electricity and natural gas) in new investment program in energy efficient renovation in public building with higher energy efficiency requirement (assumption \$ 20 million investment volume up to 2020, baseline energy use for heating powered by 30% electricity and 70% gas-fired boilers with 70% efficiency, all replaced by new gas-fired 90% efficiency boilers).

The cumulative impact for the Components 1 and 2 of NAMA are presented in Figure 15.



**Figure 15. Cumulative NAMA impact on reduction of GHG emissions by the NAMA Components 1 and 2 (ktCO<sub>2</sub>e)**

### 9.3.4. Indirect impact on energy efficiency in other (private) residential building sectors

The potential of indirect impact of the NAMA on other buildings sectors (private building) outside the direct scope of the NAMA is expected but is difficult to estimate. This concern both new construction and energy efficient renovation. This section, therefore, discusses in general terms, the potential for energy efficiency in the private sector construction activities with major share in residential building construction, without quantifying the potential NAMA impacts.

The NAMA could influence other building sectors outside the direct scope of the NAMA in several ways:

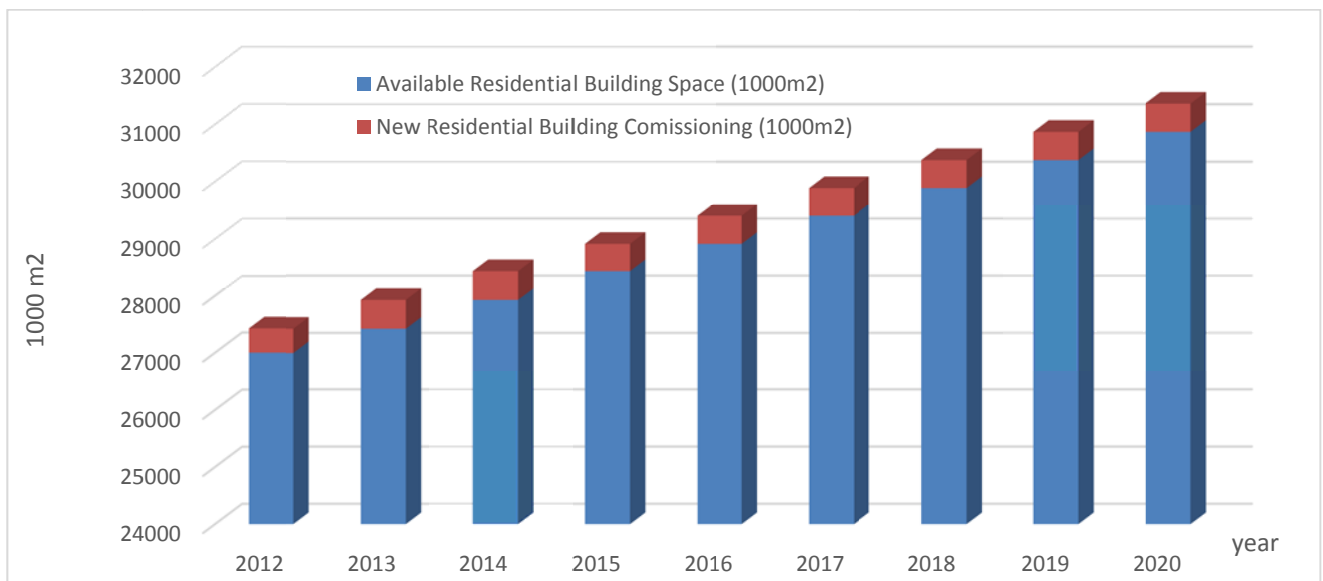
- Mainstreaming of energy efficiency in public sector building will transform the market with spin-off to the private sector;
- The NAMA can boost the market share of energy efficient construction materials supply and production.
- The NAMA will build capacity and awareness on the (economic) benefits of energy efficiency with a range of market actors (contractors, architects, suppliers, real estate brokers/companies etc.), who also serve the private sector.

## New construction

The private sector has been delivering substantial new housing construction, which has reduced during the financial crises, but recovering steadily.

The evidence from energy audits of new buildings indicates that the new housing is mostly<sup>38</sup> built without consideration of energy efficiency norms. If projecting the current trend in new residential building construction, and estimating the expected energy consumption at the commonly assessed current heating energy demand (255 kWh/m<sup>2</sup>/year) energy efficiency can bring down energy consumption in these new buildings by about 40% as a minimum. The increased energy tariffs and gradually growing market for green lending for individual household and private businesses will support the spillover effect of the energy efficient construction and renovation in the private sector.

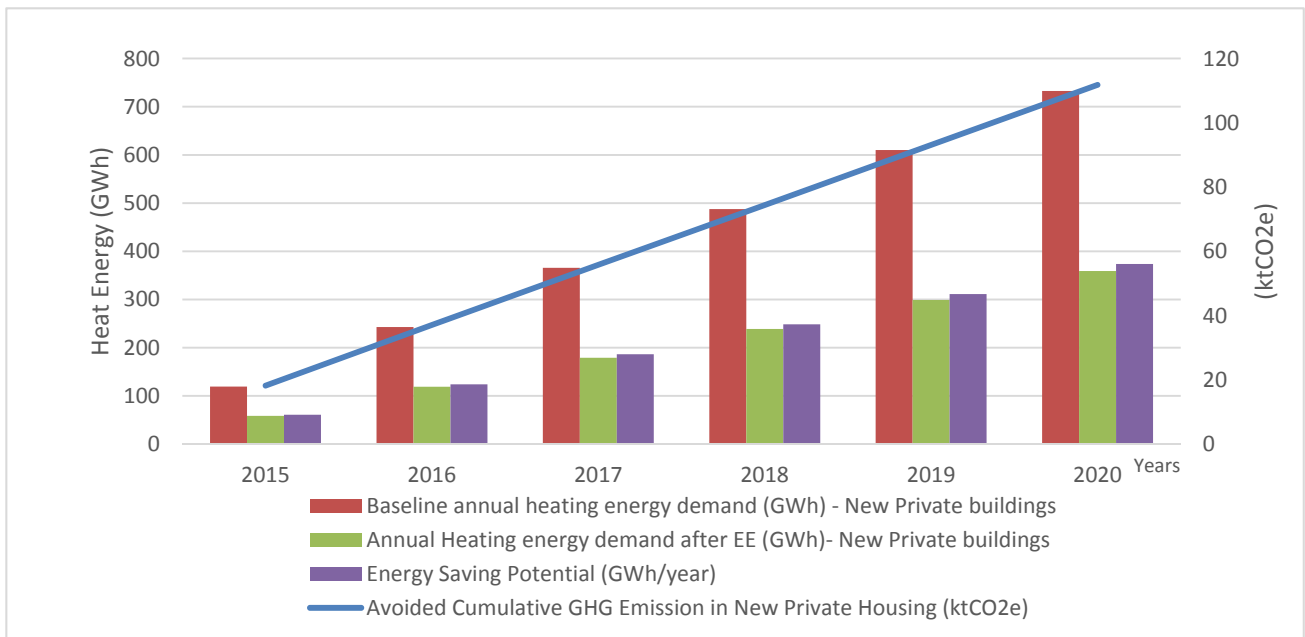
The below graph forecasts the housing construction based on current trends indicating a steady annual growth rate of 1.6-1.8%, the private housing stock will be growing at almost 500 thousand square meters per year (see **Figure 16**).



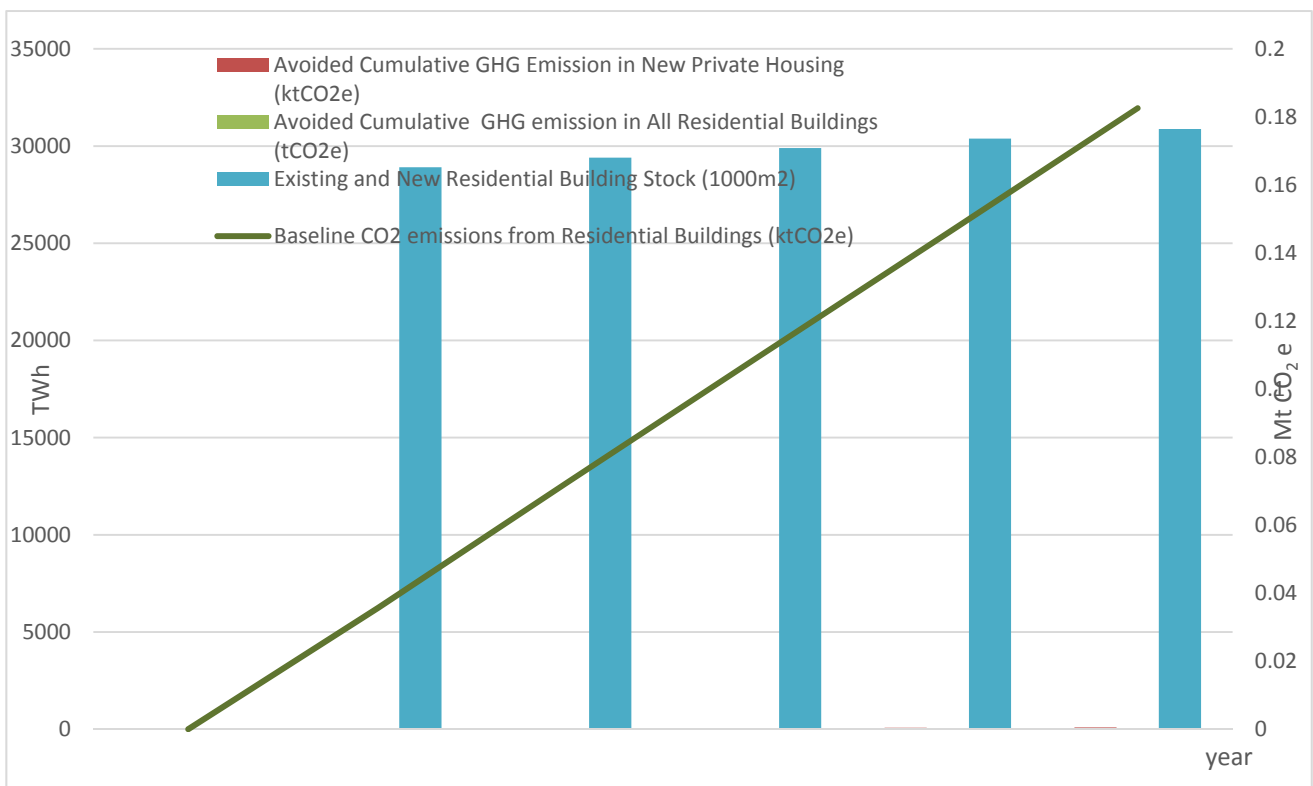
**Figure 16. Forecast of residential housing based on current trends**

<sup>38</sup> Survey conducted (in 2011) among about 35 newly-built residential multi-apartments of capital city of Armenia - Yerevan revealed that only 3 buildings complied with building code requirements exactly, another 5 ones – were closer to the requirements and the remaining did not comply at all.

The estimated business-as-usual energy consumption, as well as the scenario with energy efficiency, showing the reduced heating energy demand as well as the mitigated GHG emissions as a result of the energy efficiency measures is further presented in **Figure 17** in new housing and **Figure 18** in existing housing.



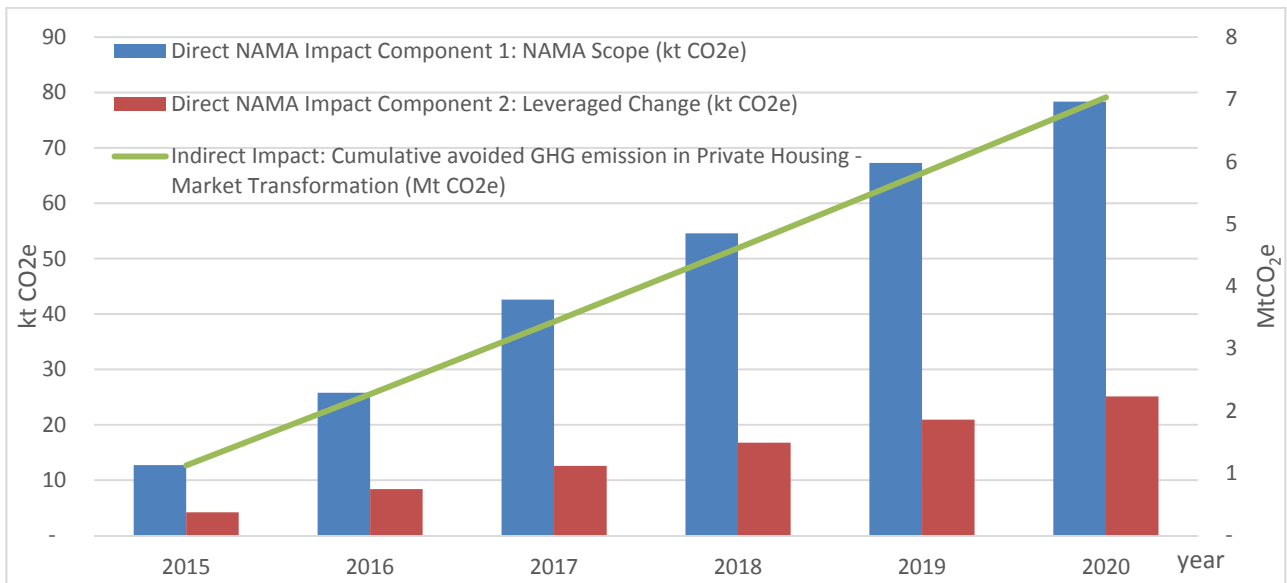
**Figure 17. Energy Saving and GHG Mitigation Potential in New Private Housing - Leveraged indirect Impact**



**Figure 18. Heat energy demand forecast with and without energy efficiency in housing stock and associated GHG emissions reduction potential**

As the direct scope of the NAMA will yield over 100 ktCO<sub>2</sub>e in mitigated GHG emissions annually, corresponding to 2 MtCO<sub>2</sub>e over the lifetime of the energy efficiency investments (20 years), while the

indirect market transformational impact could be as high as 7 MtCO<sub>2</sub>e annually (See Figure 19), of which 110 ktCO<sub>2</sub>e in new private residential construction, while the rest – due to market spill-over effect into existing residential building sector.



**Figure 19. Aggregate Direct and Indirect Impact of NAMA (MtCO<sub>2</sub>e)**

## 10 MRV and impact evaluation for sustainable development impact

### 10.1. Objective, methodology and indicators

The concept of “Nationally Appropriate Mitigation Actions – NAMAs” was introduced in the Bali Action Plan in 2007. Paragraph 1 (b) (II) calls for “Nationally appropriate mitigation actions by developing country Parties in the context of *sustainable development*.”

NAMAs may result in, and are likely to be driven by, many important societal benefits other than GHG reduction. Referred to as co-benefits, these are benefits resulting from a NAMA that are in addition to the GHG emissions reduction. Co-benefits generally pertain to the substance of the initiative, such as energy access, water conservation, improved traffic flows or more efficient farming. Some co-benefits such as positive health impacts, reduced pollution or job creation are indirect. Many of these effects may be labeled as sustainable development (SD) benefits.<sup>39</sup>

Sustainable development criteria and indicators for NAMAs should be based on national development priorities. Armenia has not officially approved a detailed list of sustainable development criteria for climate mitigation and NAMAs projects yet. However, as an alternative a defined set of basic criteria can be used/applied by the Armenian DNA for the appraisal of CDM projects. These basic criteria take into account technical, environmental, economic and policy aspects of the country's sustainable development and fall into the four following categories: environment, economic, social and political.<sup>40</sup>

These criteria will be used in the evaluation (see next section for the results). In the future, new methodologies and tools will become available, for instance those developed with UNDP support.<sup>41, 42</sup>

### 10.2. Evaluation results sustainable development impact

The table below summarises the evaluation of the NAMA impact on key development indicators, based on the evaluation framework for CDM projects in Armenia. At the current initial stage of NAMA development, only a qualitative assessment can be made. A more detailed evaluation will be made later, on the basis of quantitative indicators.

**Table 7: Evaluation framework of co-benefits in sustainable development**

Category	Criteria	Evaluation for the proposed NAMA
<b>Environmental criteria</b>	Improvement of air and water quality	N.A.
	Efficient utilisation of natural resource	Energy efficiency leads to the reduction in the use of energy resources.
	Biodiversity protection	N.A.
<b>Economic criteria</b>	Attraction of foreign investments	The NAMA main scope is public buildings and social housing. These sectors are not likely to attract foreign investments. However it is expected under Component 2, as well as strengthening energy efficiency in PPP housing could make investments in the housing sector more

<sup>39</sup> [http://mitigationpartnership.net/sites/default/files/sd\\_impacts\\_of\\_namas\\_lcd\\_wp11\\_final.pdf](http://mitigationpartnership.net/sites/default/files/sd_impacts_of_namas_lcd_wp11_final.pdf)

<sup>40</sup> <http://www.nature-ic.am/projects-approval-criteria/>

<sup>41</sup> Guidance for NAMA Design Building On Country Experiences. UNEP Risø (20103). UN/UNEP/UNDP [http://namapipeline.org/Publications/Guidance\\_for\\_NAMA\\_Design\\_2013\\_.pdf](http://namapipeline.org/Publications/Guidance_for_NAMA_Design_2013_.pdf)

<sup>42</sup> UNDP is developing a NAMA Sustainable Development Evaluation Tool (methodology and procedure). Results are expected later in 2014. The tool could be applied to this NAMA, when available at a later stage.



		attractive to foreign investments.
	Renewable energy development, energy-saving	Energy saving is the main objective of this NAMA
	Sustainable technology transfer	A strengthened market for energy efficiency in buildings will create a demand for innovative technologies (building envelope, heating systems, etc.). However, this NAMA does not explicitly require international technology support, as the objective is to support local production and manufacturing of energy efficient materials and technologies.
	Employment generation	New jobs could be created through support of local production and manufacturing of energy efficiency materials/technologies, as well as in the creating of energy efficiency services
	Development of regional and local economy	An objective of the NAMA is to support local production of energy efficiency materials/technologies as well as services  Also, energy efficiency will free up national and regional public resources that could be re-allocated supporting regional and local economies
<b>Social criteria</b>	Full participation of stakeholders	The NAMA aims to include stakeholders in development and in implementation of the NAMA.
	Creation of new jobs	New jobs could be created through support of local production and manufacturing of energy efficiency materials/technologies, as well as in the creating of energy efficiency services
	Services quality improvement	The NAMA aims to improve the quality of services through the whole building life cycle, including design, construction, renovation, management and use of the buildings. The comfort level in the public facilities will be increased due to the reduced cost for heating.
	Capacity development	A main activity of NAMA aims at developing local capacity in energy efficient design, construction and management of buildings, the experience gained with this NAMA will contribute to the scaling the low carbon transformation incentives in other sectors of economy.
<b>Political criteria</b>	Effects on national and/or regional priority objectives	The NAMA contributes to the several national and regional strategic priorities (energy security, sustainable development, social, housing)
	Effect on sector priority objectives	Energy efficiency in buildings is set as a priority in urban development strategies

## **ANNEX A. Overview volumes construction/renovation public buildings and social housing**

The Annex provides an overview of the subsectors in public buildings and (social) housing, the responsible public developers/supervisors and the planned volumes in construction and capital renovation. The following information is presented.

- Sector information
- Current plans/budgets allocated
- Projection of construction/rehabilitation volumes to 2020, as input to the NAMA impact assessment
- Energy efficiency aspects, as currently considered in new construction and capital renovation.

Information was provided by stakeholders in personal communications and in response to the official requests sent in the form of questionnaire in May 2014. The purpose of this data collection is for an initial NAMA impact assessment only, to be updated at a later stage on the basis of the final NAMA design.

ANNEX A. Investment in Building Construction in Selected Programmatic Areas and Overall Construction Sector: Historical Trends and Projections (US\$)													
Implementing agency	Building Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative volume projected (2015-2020)
<b>MUD PIU</b>	Educational, Cultural, Athletic, Residential buildings		140,743,508	93,924,674	69,915,898	99,864,824	25,776,167	16,902,826	12,815,351	18,498,115	16,072,097	15,795,187	90,064,555
<b>Health PIU</b>	Medical Institutions - New Construction					3,833,333	3,833,333	3,833,333					7,666,667
<b>Education PIU</b>	Educational Buildings (High Schools Construction)						4,540,976	2,724,585	2,724,585	2,724,585	2,724,585		15,439,317
<b>Armenia SIF</b>	Educational, Pre-school, Cultural, Athletic, Social buildings (Repair/Reconstruction)	8,209,167	6,177,444	4,640,820	3,351,397	6,423,179	6,000,000	9,500,000	14,000,000	5,250,000	5,025,000		39,775,000
<b>ASBA Social Housing Foundation</b>	Affordable rental housing construction					950,000	1,500,000	2,250,000	2,250,000	2,250,000	3,000,000	3,000,000	14,250,000
<b>Yerevan Municipality*</b>	Emergency Building Resettlement - Construction of New Residential Housing		2,032,520	2,032,520	3,942,276	3,644,878	2,032,520	3,942,276	3,644,878	2,032,520	3,942,276	3,644,878	19,239,350
<b>"Hayastan" All Armenia Fund*</b>	Ad-hoc Charity Reconstruction of Public Buildings			1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	6,000,000
<b>Total volume covered by NAMA beneficiaries</b>		8,209,167	148,953,472	101,598,014	78,209,572	115,716,214	18,906,829	40,153,021	36,434,814	31,755,220	31,763,959	23,440,065	182,453,909
<b>Nation-wide construction investments</b>		1,429,144,903	1,225,302,184	1,163,630,097	1,272,692,395	1,220,541,559	1,218,954,684	1,237,396,212	1,225,630,818	1,227,327,238	1,230,118,090	1,227,692,049	7,367,119,090
<b>State-funded construction</b>		152,616,505	211,375,728	206,297,330	190,096,521	202,589,860	199,661,237	197,449,206	199,900,101	199,003,515	198,784,274	199,229,296	1,194,027,629
* - the organization has no accurate quantitative forecasts on future investment, the volume indicated is an estimate based on linear extrapolation of the past investment volumes													
** - italicized numbers are forecasted based on past trends													

Building Areas (m<sup>2</sup>)

Implementing agency	Type building	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative volume projected (2015-2020)
MUD PIU	Educational, Cultural, Athletic, Residential buildings		118,903	77,971	59,116	84,518	85,065	96,297	101,408	107,298	113,488	119,678	623,234
Health PIU	Medical Institutions			833	5,841	14,341	13,507	8,500					22,007
Education PIU	Educational Buildings (High Schools Construction)						15,148	9,089	9,089	9,089	9,089		51,503
Armenia SIF	Educational, Pre-school, Cultural, Athletic, Social buildings (Repair/Reconstruction)	82816	29,686	23,353	20,798	37,295	37,295	41,390	108,826	20,326	24,791		232,627
ASBA Social Housing Foundation	Affordable rental housing construction					1,280	4,000	5,500	5,500	5,500	7,500	7,500	35,500
Yerevan Municipality*	Emergency Building Resettlement - Construction of New Residential Housing		43,000	68,000	54,000	56,000	50,000	50,000	50,000	50,000	50,000	50,000	300,000
"Hayastan" Armenia Fund*	All Ad-hoc Charity Reconstruction of Public Buildings						10,000	10,000	10,000	10,000	10,000	10,000	60,000
Total volume		82816	191,588	170,157	139,755	193,433	215,015	220,776	284,822	202,212	214,868	187,178	1,324,872

\* - for cases, when building size information was not available, it was assumed that the building was about 1000m<sup>2</sup> based on the average size of kindergartens and music schools

## Number of buildings construction/reconstruction by partner by year

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative number projected (2015-2020)
Implementing agency	Type building	Number of Constructed/reconstructed Buildings											
MUD PIU	Educational, Cultural, Athletic, Residential buildings		30	30	30	30	30	30	30	30	30	30	300
Health PIU	Medical Institutions					1	3	3					7
Education PIU	Educational Buildings						5	4	4	4	3		20
Armenia SIF	Educational, Pre-school, Cultural, Athletic, Social buildings	55	34	24	21	26	24	38	56	21	21	-	320
ASBA Foundation	Affordable rental housing					2	3	4	4	4	5	5	27
Yerevan Municipality*	Emergency Res. Building Replacement		43	68	54	56	50	50	50	50	50	50	521
"Hayastan" All Armenia Fund*	Ad-hoc Charity Reconstruction of Public Buildings	2	3	4	1	2	2	3	2	3	2	3	27
Total volume		57	110	126	106	117	117	132	146	112	111	88	1,222

\* - for cases, when building size information was not available, it was assumed that the building was about 1000m<sup>2</sup> based on the average size of kindergartens and music schools

\*\* - the organization has no accurate quantitative forecasts on future investment, the volume indicated is an estimate based on linear extrapolation of the past investment volumes

\*\*\*- All data for future years are estimates either based on institutional projections or extrapolation of current trends by UNDP-GEF local team