Terminal Evaluation Report
of the

UNDP-GEF Project
'Improving Energy Efficiency in Buildings'
in Armenia

PIMS 4245

By
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The Terminal Evaluation of the UNDP-GEF project "Improving Energy Efficiency in Buildings" was carried out between February and August, 2016.

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Acronyms and Abbreviations

ADB	Asian Development Bank
APR	Annual Project Review
AWP	Annual Work Program
BAU	business-as-usual
CC	Climate Change
ESIB	Energy Saving Initiative in the Building Sector in Eastern Europe and Central Asia
EE	Energy Efficiency
EIB	European Investment Bank
EPBD	Energy Performance of Buildings Directive (EU)
EU	European Union
FSP	Full-Sized Project
GEF	Global Environment Facility
GCF	Green Climate Fund
GHG	Greenhouse Gases
IA	Implementing Agency
IAWG	Inter-Agency Working Group
IBDA	Integrated Building Design Approach
INOGATE	INterstate Oil and GAs Transportation to Europe
kWh/m^{2}a	kilowatt-hour per square meter and year
LEED	Leadership in Energy and Environmental Design
ME	Ministry of Economy
MENR	Ministry of Energy and Natural Resources
MNP	Ministry of Nature Protection
MSN	Interstate Building Code
MTE	Mid-Term Evaluation
MUD	Ministry of Urban Development
NGO	Non-Governmental Organization
PB	Project Board
PIR	Project Implementation Report
PIU	Project Implementation Unit
PMU	Project Management Unit
PSC	Project Steering Committee
QA/QC	Quality assurance/Quality Control
R2E2	Armenia Renewable Resources and Energy Efficiency Fund
SDC	Swiss Development and Cooperation Agency
SDG	Sustainable Development Goal
SNiP	Building Standards and Rules (Codes)
TA	Technical Adviser
TE	Terminal Evaluation
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNDP-CO	United Nations Development Programme Country Office
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
YSUAC	Yerevan State University for Architecture and Construction

Executive Summary

The implementation of the full-scale UNDP-GEF Project "Improving Energy Efficiency in Buildings" began in July 2010. The project was designed to: reverse the existing trends and reduce consumption of electrical and thermal energy and associated GHG emissions in new and restored, primarily residential buildings in Armenia. It was to do this by creating enabling regulatory environment, skills and capacity among industry professionals to introduce the principles of integrated building design in Armenian construction practices from the stage of building design through construction to maintenance of the buildings. The support provided by the project combined development of a new regulation framework (EE building codes and certification scheme) with the training of professionals, demonstration of integrated building design and stimulating manufacturing and testing of new EE materials and equipment.

The project was completed on June 30, 2016.

Project Summary Table

Project Title:	LGGE Improving Energy Efficiency in Buildings			
GEF Project ID:	00059937		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	00075196	GEF financing:	1.045	1.045
Country:	Armenia	IA/EA own:	0.15	0.15
Region:	Europe and Central Asia	Government:	2.2	2.2
Focal Area:	Climate Change	Other:	-	12.1*
FA Objectives, (OP/SP):	CC-SP1-Building EE	Total co-financing:	2.35	14.45
Executing Agency:	Ministry of Nature Protection	Total Project Cost:	3.395	15.495
Other Partners involved:	Ministry of Urban Development	ProDoc Signature (date project began):		05 July 2010
		(Operational) Closing Date:	Proposed: July 2015	Actual: June 30, 2016

* To be re-assessed at the project completion.

Brief Description of the Project

The project was implemented under the UNDP-led GEF Global Framework for Promoting Low Carbon Buildings (LGGE) with a primarily focus on two thematic approaches promoted by the Global Framework: a) promotion and increased uptake of high quality building codes and standards; and b) developing and promoting energy efficient building technologies, building materials and construction practices. The coordination offered by the global program has helped Armenia to learn from experiences and best practices from countries with similar EE building projects.

The project approach of institutionalizing improved energy efficiency in buildings through building codes, construction materials certification, training, and demonstration directly contributes to the pursuit of Millennium Goal Number 7: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. The project has further contributed to the pursuit of Sustainable Development Goals (SDGs), in particular to SDG 7: Affordable and Clean Energy, SDG 11: Sustainable Cities and Communities, SDG 12 Responsible Consumption and Production and SDG 13: Climate Action The project approach also builds on one of the key areas of the UNDP Armenia Country Programme: to "strengthen synergies of environmental, governance and socio-economic issues to ensure integrated solutions."

Acknowledging that 88% of buildings in the total non-commercial building stock of Armenia is in the residential sector, this project was directed towards enhancing energy efficiency in residential buildings. However, it is important to note that activities which supported a new, energy-efficient building code covering not only construction and capital renovation of residential buildings but also non-residential buildings, thus leading to wider replicability and sustainable impact.

In pursuit of the objective, the project was designed to deliver the following outcomes:

1. New EE Building Codes and/or Standards designed and enforced
2. Quality control, testing and certification of EE materials and equipment established
3. Outreach, training and education implemented/conducted
4. Integrated building design approach demonstrated on a selected multi apartment building
5. Project monitored and evaluated

Evaluation Rating Table

Evaluation Ratings:			
1. Monitoring and Evaluation	***rating***	**2. IA & EA Execution**	***rating***
M&E design at entry	**S**	Quality of UNDP Implementation – Implementing Agency (IA)	**HS**
M&E Plan Implementation	**S**	Quality of Execution - Executing Agency (EA)	**HS**
Overall quality of M&E	**S**	Overall quality of Implementation / Execution	**HS**
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance	**R**	Financial resources:	**L**
Effectiveness	**HS**	Socio-economical:	**L**
Efficiency	**HS**	Institutional framework and governance:	**L**
Overall Project Outcome Rating	**HS**	Environmental:	**L**
		Overall likelihood of sustainability:	**L**

Explanation of Rating Scales

Ratings for Effectiveness, Efficiency, Overall Project Outcome Rating, M&E, IA & EA Execution	***Sustainability ratings:***	***Relevance ratings:***
Highly Satisfactory (**HS**): no shortcomings **Satisfactory** (**S**): minor shortcomings **Moderately Satisfactory** (**MS**): moderate shortcomings **Moderately Unsatisfactory** (**MU**): significant shortcomings **Unsatisfactory** (**U**): major shortcomings **Highly Unsatisfactory** (**HU**): severe shortcomings	**Likely** (**L**): negligible risks to sustainability **Moderately Likely** (**ML**): moderate risks **Moderately Unlikely** (**MU**): significant risks **Unlikely** (**U**): severe risks	Relevant (**R**) Not relevant (**NR**)
Additional ratings where relevant: Not Applicable (N/A)	Unable to Assess (U/A)	

Summary of conclusions, recommendations and lessons

The Terminal Evaluation of the UNDP-GEF project 'Improving Energy Efficiency in Buildings' was carried out between February and August, 2016. The document review and evaluation mission took place more than 4 months before the EoP and the Draft Evaluation Report for was issued in mid-April. This allowed the project team to finalize key outcomes and address critical comments and recommendations before the EoP on June 30. The project was re-assessed following EoP in light of the achievements realized in the final months of the project. In particular, the endorsement of the new EE building code 'RACN 24-01-2016: Thermal Protection of Buildings' and the approval and inception of the US$120 million GCF/EIB project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits' developed by the project and based largely on the success of its demonstration buildings have made a substantial difference in terms of the accountable impact and sustainability of the project results.

The project progress overall can be considered as highly satisfactory and mostly in line with the project document for all 4 components. Under Component 1 the new EE construction norm 'RACN 24-01-2016: Thermal Protection of Buildings' and amendments to the law On Energy Saving and Renewable Energy have been enacted which effectively implement new mandatory requirements for building energy efficiency in the building sector including new residential muti-apartment buildings and public sector buildings. Much has been achieved by the project in terms of updating standards and norms for EE in building sector. Based on actual and projected building volumes, the new manatory EE regulations shall generate 323 ktCO2 direct and post-project direct ER . The project has been particularly successful in the demonstration and outreach components. Over 8 pilot sites demonstrate the cost-efficiency and comfort of EE in new and rehabilitated buildings in the residential and public building sectors. 12,5 ktCO2 direct ER has been generated from demonstration components and the prospects for replication are very high. The project has been able to position itself as a centre of competency for energy efficiency within the Government in Armenia. The project has cooperated well with private sector: construction materials testing laboratories; insulation materials producers; real estate brokers, public and residential building developers, schools and design institutions. Two insulation materials testing laboratories, equipped and operational by the project midterm, contribute to the sector development. Market share of locally produced, tested and certified insulation materials has increased.

Actions and Recommendations to reinforce initial benefits from the project

- The project has developed and initiated a comprehensive 'exit strategy' in the form of the US$ 120 million Green Climate Fund/European Investment Bank Project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits.' This approved 20-year project addresses public and residential buildings and builds upon and strengthens the long-term impact of the project.
- An accountable methodology (GEF GHG Accounting Tool for EE projects: GEF EE Tool v1.0) has been applied to calculate the energy and GHG savings from the project period, based on the results of the pilot projects and for new buildings which shall be constructed according to the new building code.
- The newly updated mandatory building code 'RACN 24-01-2016 Thermal Protection of buildings' has been endorsed in the final week of the project.. Enforcement capacity should be developed and implemented. Further, the minimum building energy performance requirements defined in the new

mandatory code need to be tightened regularly (at least every 5 years) in response to developments and opportunities in the EE building market.

- The transition to performance based codes (based on maximum kWh/m^2yr including heating and cooling loads) needs further support and development. Local experts need further contact with international expertise and best practice tools. A spreadsheet application for building energy performance calculation (kWh/m2.a) and certification which incorporates national climate data, calculation methodologies and code requirements has been developed and made widely available as a tool for students, building professionals and designers. The tool is available free on the project website: http://www.nature-ic.am/improving-ee-in-buildings-reports-and-publications
- The numberous pilot projects have demonstrated cost and energy efficiency and attracted the interest of local developers and real estate companies in realizing energy efficient buildings. These professionals should be further supported through outreach, information and administrative incentives. Government incentives and financing mechanisms should be developed and implemented to help support further public and private sector investments in EE measures and practices for buildings.
- Tariff structures (in combination with possible financial incentive programmes) should be evaluated based on the potential of increasing private sector investment in EE / RE technologies.

Lessons Learned;

- The new EE building code was endorsed in the final week of the Project. Improving EE building codes is an effective means to influence the large volume of buildings necessary to achieve substantial impact. However, according to GEF calculation methodologies, accounting the immenselargely post-project impact of such projects remains highly dependent on the timely implementation of legislation and national building programmes. Delays in the endorsement of legislation or implementation of government programmes are a common recognized risk in these types of projects.
- Energy efficient rehabilitation of the existing building stock in Armenia is still practically non-existent due to scarce financing and low capacity of building owners and utilities to accept and repay loans. In this respect, the project's efforts to address this issue by demonstrating solutions and leveraging financing for this sector should be commended. The leveraging of US$120 million investment in the form of the 20-year Green Climate Fund/European Investment Bank Project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits' which addresses EE in existing public and residential buildings will reinforce initial benefits from the project. Further, the focus of the project on development of an energy efficiency code for buildings and development of the local capacity in Integrated Building Design Approach is perhaps one of the most effective strategies applicable to Armenia. Such a strategy has had a limited impact in the short-term (during project implementation) due to its relatively long adoption and implementation time. However, its long-term potential impact in terms of CO2 savings is substantial.
- Pilot projects designed, realized and monitored under the project have provided verifiable cost savings of EE measures for Armenian construction market. The

use of standard building layouts developed prior to project implementation meant many key opportunities to achieve and showcase the benefits of some proven no-cost, low-cost measures (compact building form, orientation to benefit from solar gains, etc) were not identified and implemented in the demonstration projects. This lesson is not particular to this project but is a general problem applicable to many building sector EE projects which set out to demonstrate the Integrated Building Design Approach but end up applying insulation to standardized designs. Although the resulting buildings are more EE, they do not take full advantage of the potential energy and lifecycle cost efficiency of IBDA.

- An accountable national building material, component and equipment testing and certification scheme supports the quality and consumer confidence in EE technologies. Material and equipment certification enables planners, investors and consumers to make informed decisions regarding up-front costs (based on quality of the product) and long-term saving potential. Material certification also supports quality control and verification of code compliance at the building site.
- Demonstration buildings need to strike a careful balance between showcasing new technologies and using traditional construction methods and practices. For the most part building materials and practices used in the public demonstration buildings were local – this ensured a good cost balance and a high replication potential.

Introduction

The Terminal Evaluation of the UNDP-GEF project 'Improving Energy Efficiency in Buildings' was carried out between February and August, 2016. The document review and evaluation mission took place more than 4 months before the EoP and the Draft Evaluation Report for was issued in mid-April 2016. This allowed the project team to address critical comments and recommendations before the EoP on June 30 2016. The project was re-assessed following EoP in light of the achievements realized in the final months of the project.

Purpose of the evaluation

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

Scope & Methodology

This Terminal Evaluation has been conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The Terminal Evaluation assignment has been implemented according to the following methodology:

1) **Preliminary documentation review (February 2016)**

The initial stage involved the review of project documentation, project reports and associated documents. The documentation has been provided by the UNDP Country Office, the Project Manager and downloaded from the project website.

The evaluation team has reviewed all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, in particular, the evaluator has validated data using the project files, national strategic and legal documents, and any other materials that the evaluation team has considered useful for this evidence-based assessment. A list of documents that the evaluator has reviewed is included in Annex E

2) **Inception Report and preparation for mission**: **(February 2016)**

Through discussions with the Project Manager, the following were prepared;

- Interviewees were selected so as to provide a broad sample of the different groups or people involved in and influenced by the project (Annex C)
- Itinerary for the local mission was proposed and developed (Annex B)
- A standard interview format (questionnaire) for the project team, stakeholders and beneficiaries was drafted and submitted (Annex G).

3) **Evaluation Mission (February 22 to 26, 2016):**

Interviews were conducted with UNDP, the project management team, key stakeholders and beneficiaries (Annex C). A selection of pilot demonstration buildings was visited (Annex D). The project team assisted the evaluation team by arranging interviews and travel. The mission itinerary (Annex B) included;

(a) Presentations and explanations by the project management team.
(b) Stakeholder and beneficiary interviews (Annex C)
(c) Field visits to pilot projects (Annex D)
(d) Collection of additional documentation.
(e) Presentation and discussion of preliminary findings and recommendations to the project team
(f) Wrap-up presentation with UNDP

4) **Further telephone interviews**

A further interview with the UNDP Regional Technical Advisor responsible for the project was carried out via Skype.

5) **Data analysis:**

Following the mission, the collected data and opinions were compiled and analyzed. Multiple, sources of information were assessed to ensure an evaluation according to GEF/UNDP Monitoring and Evaluation Policy.

6**) Preparation of Draft Terminal Evaluation Report (March/ April 2016)**

The Terminal Evaluation Report was prepared based on the interviews with the relevant stakeholders and the review of available documentation. The Report includes relevant comments and suggestions raised by UNDP, the project team and the national stakeholders interviewed as well as the findings and opinions of the authors.

7**) Response to comments and submission of final Terminal Evaluation Report (July/ August 2016):**

Questions and comments to the Draft Terminal Evaluation raised by project stakeholders are responded to and incorporated into the final document.

Structure of the Terminal Evaluation Report

This Terminal Evaluation Report follows the structure outlined in the Evaluation Report Outline included in the Terminal Evaluation Terms of Reference (Annex A).

This Terminal Evaluation is based on a performance assessment approach guided by the principles of results-based management. The evaluation tracks impact according to the Logical Framework. The contribution of project outputs and project management is evaluated with reference to the achievement of the project outcomes and overall objective. This Terminal Evaluation reviews the implementation experience and achievement of the results of the project in question against the Project Document endorsed by GEF, including any changes made during implementation.

Project description and development context

The project was designed to: reverse the existing trends and reduce consumption of electrical and thermal energy and associated GHG emissions in new and restored, primarily residential buildings in Armenia. It was designed to do this by creating enabling regulatory environment, skills and capacity among industry professionals to introduce

the principles of integrated building design in Armenian construction practices from the stage of building design through construction to maintenance of the buildings. The support provided by the project combine development of a new regulation framework (EE building codes and certification scheme) with the training of professionals, demonstration of integrated building design and stimulating manufacturing and testing of new EE materials and equipment.

Project start and duration

The implementation of the full-scale UNDP/GEF Project 'Improving Energy Efficiency in Buildings' in Armenia began in June 2010. The project's original planned duration was 5 years (original planned completion was July 2015.) The project was completed on June 30, 2016. A no-cost, one-year project extension (to June 30, 2016) was initially proposed in the MTE as a means to enable more comprehensive monitoring and evaluation of the demonstration projects. In effect, the extension proved most beneficial for the realization of two key Project accomplishments; the development and endorsement of the new EE building code 'RACN 24-01-2016: Thermal Protection of Buildings' and the approval and inception of the US$120 million GCF/EIB project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits' both of which were approved in the final weeks of the Project.

Problems that the project sought to address

65% of Armenia's population of 3.23 million inhabitants lives in urban areas. There are over 400,000 apartments with a total area of 25 million m2 in multi-apartment buildings. The largest portion of the urban housing stock is between 30 and 60 years old, and it typically has poor thermal characteristics and is poorly sealed.

Without exception, all old buildings require some type of repairs, and 11% of the buildings are in urgent need of reconstruction. Buildings represent the largest energy end-use sector, accounting for 35.5% of electricity and 25.3% of gas consumption in Armenia (a major portion of both is consumed to cover the heating load, due to the absence/collapse of the centralized district heating system and switching to the individual heating options),[1] and this sector offers the single largest and most cost-effective opportunity to improve energy efficiency: 40% of the national energy saving potential is in the buildings, an equivalent of 402,000 toe or 944,000 tCO_2e of GHG emission reductions annually.[2] The buildings sector is also the second fastest growing sector (after transport) in terms of energy use and GHG emissions: in 2002-2005 consumption of natural gas in residential and public buildings grew by 206% and 85% respectively.

Growth in emissions from the building sector results in part from a construction boom that began in Armenia in early 2000, when construction volume began to increase on average by 15-20% annually. The GDP has been growing rapidly since 2001 at above 10% annually, with the construction sector contributing 28-30% of GDP in 2008. In addition, there is a stated government commitment to implement the Program for restoration of the areas that suffered from the disastrous 1988 earthquake. In November 2008, the Prime Minister declared the full reconstruction of the earthquake zone was among the government's priorities and pledged 77 billion Drams (approximately USD

[1] Ministry of Energy, Calculation Center (2006 report).
2 National Programme on Energy Saving and Renewable Energy of Republic of Armenia (2007).

250 million) for finalizing the construction of new housing for the 75,000 people still living in temporary dwellings. The state-supported program will construct over 460,000 m^2 of residential stock during the 2009-2013 in the northern regions of Armenia.

At project start, building construction was carried out using existing outdated building codes. The building codes were not designed with energy efficiency in mind. For example, the code pertaining to the thermal resistance of building envelope elements bore non-binding recommendations. Most designers use a Soviet-era code (SNiP) dating from 1979, which set the minimal thermal resistance requirements (R-values) for the building envelope elements in accordance with sanitary norms. The building codes "Thermal physics of the building envelope" (1995) were adapted based on the corresponding Russian codes, and they did not provide IBDA, building energy performance limitations and building energy passport form.

Immediate and development objectives of the project

The objective of the project was to reduce GHG emissions and energy consumption in the Armenian buildings sector. The project was designed to create an enabling regulatory environment that addressed building codes, building and materials certification and testing. At the same time, project activities were intended to develop skills and capacity among industry professionals, introducing the principles of integrated building design in Armenian construction practices from the stage of building design through construction, QA/QC and maintenance.

Keeping in mind that 88% of buildings in the total non-commercial building stock of Armenia is in the residential sector, this Project was directed towards enhancing energy efficiency in residential buildings. However, it is important to note that activities supporting a new, energy-efficient building code were intended to cover not only construction and capital renovation of residential but also non-residential buildings, thus leading to wider replicability.

With the GEF support, the existing building codes and standards were to be enhanced and mandated, and the integrated building design approach (IBDA) was to be applied to new construction leading to up to a 40-50% reduction in specific energy consumption for heating in residential sector from the current average of 160 kWh/m^2 year down to 96 kWh/m^2 year by 2013 for improved code component and down to 80 kWh/m^2 year for IBDA component by 2012.

The project was consistent with GEF-4 Strategic objective CC – 1 "To promote energy-efficient technologies and practices in the appliances and buildings," because it aimed to promoting energy- efficient technologies and practices in buildings.

The project was implemented under the UNDP-led GEF Global Framework for Promoting Low Carbon Buildings with a primarily focus on two thematic approached promoted by the Global Framework: a) Promotion and increased uptake of High Quality Building Codes and Standards; and b) Developing and Promoting Energy Efficient Building Technologies, Building Materials and Construction Practices. The coordination offered by the global program helped Armenia to learn from experiences and best practices from countries with similar EE building projects in the region (Kyrgyzstan, Uzbekistan, Kazakhstan and Turkey) and good practice building codes and standards work done in other CIS countries.

Outcome 1: Design and enforcement of new EE Building Codes and Standards;

Outcome 2: Quality control, testing and certification of EE materials and equipment;

Outcome 3: Outreach, training and education; and

Outcome 4: Demonstrating integrated building design;

Baseline Indicators established

The following assumptions outlined in the ProDoc characterized the business-as-usual scenario in the buildings sector in Armenia:

1. The *speed and the significance of improvement* in the national energy-efficiency building codes. According to the MUD regulations, construction norms should be updated every five years based on the latest know-how and best building practices. In reality, however, the only EE related construction code that was adopted in post-Soviet era was the 1995 code (amended on 1998 with approval on 2001) with no limitations on energy performance and no IBDA. No EE related code was revised/adopted in the last 10 years, and without the Project, it was quite unlikely that it will happen soon. However, in order to be conservative, it was assumed that energy requirement for heating in new buildings wa expected to be improving at the rate of 1% per year starting in 2011 (i.e. going down from the current average of approximately 160 kWh/m^2/year to 152 kWh/m^2/year in 2015 and further to 138 kWh/m^2/year by 2025). These initial assumptions proved conservative. The energy audit of the new residential building in Goris for example, showed a baseline consumption of 217kWh/m2a before EE measures and 78 kWh/m2a after implementation of EE measures. 2. The *compliance rate* for building codes. Relatively low compliance of buildings with building codes is a worldwide problem encountered not only in developing and transition economies but also in developed ones. For the purpose of calculations, it was assumed that in BAU scenario the buildings to be built at least comply fully with the minimal sanitary norms on EE (which actually often is not the case). A survey conducted by the Project in 2011 found that out of 35 new buildings built in Yerevan, 3 were built compliant to the existing voluntary thermal protection norms, a further 5 were built close to the requirements of the norm and the rest were non -compliant.
3. *Building construction volumes:* Armenia has 21,778 multi-unit residential buildings, with a total of 429,500 apartments, accounting for 25 million m^2. The city of Yerevan accounts for approximately half of all multi-apartment housing in Armenia by floor space. Annual construction volumes growth average rate was around 12% before the 2008. In 2009, the growth rate decreased by almost 40% because of the global financial crisis; the 2010-2024 growth trend is assumed to be 2% annually in post crisis years and later will grow up to 6%, linked to the anticipated GDP growth rate.[3]. The state supported program for 2010-2013 on earthquake zone restoration (which envisages commission of some 460,000 m^2 of residential housing in the earthquake zone) was also taken into account and calculated separately. Updated government surveys from the National Statistical Service of Armenia show a continued general decline in annual new residential construction volumes from 520 thousand m2 in 2010 to 227 thousand m2 in 2015.

In a business-as-usual scenario, state- and commercially-funded construction and renovation in Armenia were to be implemented using outdated building norms and practices and with no regard given to energy efficiency, resulting in excessive energy use. GEF assistance was requested to help overcome a number of barriers, which prevented adoption of more energy-efficient construction practices in buildings. Under

[3] Armenia: Second National Communication on Climate Change to UNFCCC

the BAU scenario, the annual emissions from the Armenian building stock would grow some 70% from current level of around 1 $MtCO_2eq$ to over 1.7 $MtCO_2eq$ by 2025.

Main stakeholders

The project executing agencies are jointly the Ministry of Nature Protection and the Ministry of Urban Development of the Republic of Armenia.
The implementing agency is UNDP Armenia.

Main Project stakeholders identified in the Project Document to be actively involved in project implementation include:

- Ministry of Nature Protection (MNP)
- Ministry of Urban Development (MUD) - both acting as executing agency
- GEF Focal Point at MNP
- Ministry of Energy and Natural Resources (MENR)
- Ministry of Economy (ME)
- Inter-Agency Working Group on Energy Efficient Building Codes (IAWG)
- State Urban Inspectorate under the Ministry of Urban Development
- Yerevan State University of Architecture and Construction
- Builders' and Architects' Unions of Armenia
- Armenia Renewable Resources and Energy Efficiency Fund (R2E2)
- National Institute of Standards
- Accredited laboratories for construction and construction/insulation materials QA/QC
- The World Bank, USAID/EE Energy, European Union and other donors' funded projects in energy and building EE sectors

During Project implementation, additional Project stakeholders have been involved in the execution and co-ordination of Project activities:

- Swiss Development and Co-operation Agency SDC (supported the demonstration project in Goris town)
- Yerevan municipality (EE housing refurbishment)
- Architects, design and construction companies and project developers involved in the design and implementation of demonstration projects

Expected Results

The Project Document specified the expected Project results and project outputs for each of the Project component that related to each of the Project's immediate objectives.

1. **Immediate objective/outcome 1:**
   Design and enforcement of new EE Building Codes and Standards: new building codes will be designed emphasizing energy performance requirements for all types of buildings, and code enforcement mechanisms will be strengthened.

   Output 1.1: New mandatory EE building code designed and introduced
   Output 1.2: Standards and calculation methodology to assess energy performance in buildings

Output 1.3: Institutional structures, staffing, capacities and accountability for agencies in charge of code enforcement

2. **Immediate objective/outcome 2:**
Quality control, testing and certification of EE materials and equipment: focus on establishing quality assurance/quality control (QA/QC) standards and support the certification of key building materials for energy performance.

Output 2.1: Standards for internal QA/QC developed and piloted
Output 2.2: Testing laboratory for EE products and certification operating

3. **Immediate objective/outcome 3:**
Outreach, training and education: training provided to two distinct groups: (1) architects and engineers (both mid-career professionals and students) and (2) real estate professionals.

Output 3.1: Modules on EE buildings introduced to universities
Output 3.2: Training courses for architects and engineers on new codes and calculation methodologies
Output 3.3: Outreach and awareness-raising campaign targeting investors and tenants implemented.

4. **Immediate objective/outcome 4:**
Demonstrating integrated building design: the energy and cost-saving potential of the integrated building design approach (IBDA[4]) will be demonstrated in a new, multi-apartment residential building to be built in the 1st Zone, the coldest of Armenia's climatic zones.

Output 4.1: At least one building designed and constructed using an integrated building design approach
Output 4.2: Energy saving and GHG reductions in pilot building monitored and reported

[4] The **Integrated Building Design Approach (IBDA)** as it is discussed in the project documentation is understood as follows: building design that integrates climatic conditions, the capture and the conservation of the free solar and internal gains, the efficient and comprehensive reduction of all heat losses through walls and ventilation, the accurate control of all external energy introduced for providing thermal comfort, light, and hot water, and – last but not least – user awareness of a new behaviour regarding energy use and good operations and maintenance practices. The concept of IBDA calls for architects and engineers to work as a team in order to ingrate these conceptual parameters and the needs of the tenants. The ultimate goal of applying IBDA is to achieve high performance and multiple benefits at a lower cost than the total for all the components combined if these were considered separately.

Findings

Project Design / Formulation

Analysis of the LFA/Results Framework (Project logic/ strategy; indicators)

As an instrument for planning activities under the implementation framework defined in the Project Document, the logframe was used for reporting to GEF in the combined Annual Project Review (APR) and Project Implementation Report (PIR), and for Project management and reporting to UNDP on a quarterly and annual basis (Progress Reports). The logframe adequately facilitated the tracking of implementation targets for each year of project implementation and was thereby suited for the operational evaluation of Project progress.

However, as a tool for adaptive management, the Logframe lacked a clear hierarchical structure with distinctions between output, outcome and impact level results, indicators and targets. In the Results Framework of the Project Document, the term 'Output' is loosely applied to all expected results, indicators and targets (the indicators and targets generally describe expected outcome and impact level results.) This structure was maintained throughout the project. The lack of a clear structure describing the 'logical' progression from project outputs (or deliverables) to expected outcomes (or results) and ultimately to overall impacts meant that problems in meeting targets or deadlines were considered in isolation and not in relation to the project's impact target (in particular, 60ktCO_2 emission reductions from new residential buildings to be built during the project lifetime). Following the mid-term evaluation, the deadlines for meeting several key outcomes (new codes, audit protocols, passport guidelines, code enforcement program) were simply shifted from the project mid-term to the end-of-project without consideration of or compensation for the effect of this shift on the expected project impact. In the second half of the project implementation (including in the one-year no-cost project extension), the project team was able to realize these key deliverables and some additional achievements (including the US$120 million GCF/EIB project) which enabled project results of high impact and sustainability.

Further, although indicators, targets and deadlines were defined in the logframe, several lacked a clear means for tracking progress with definitive sources of validation (ie. use of IBDA concepts in new buildings). External indicators and targets with which to track the real market uptake of EE technologies, for example, data from new building permits, from sales of insulation products or Government spending on EE measures in their building programmes would have provided reliable indications of project progress with a clear link to the project's CO_2 ER targets.

Assumptions and Risks

In the Project Document, the key assumptions concerning the project benefits over the business-as-usual (BAU) scenario included:

1. **Revisions to national energy-efficiency building codes**. The existing building codes and standards were to be enhanced so as to mandate the reduction of heating

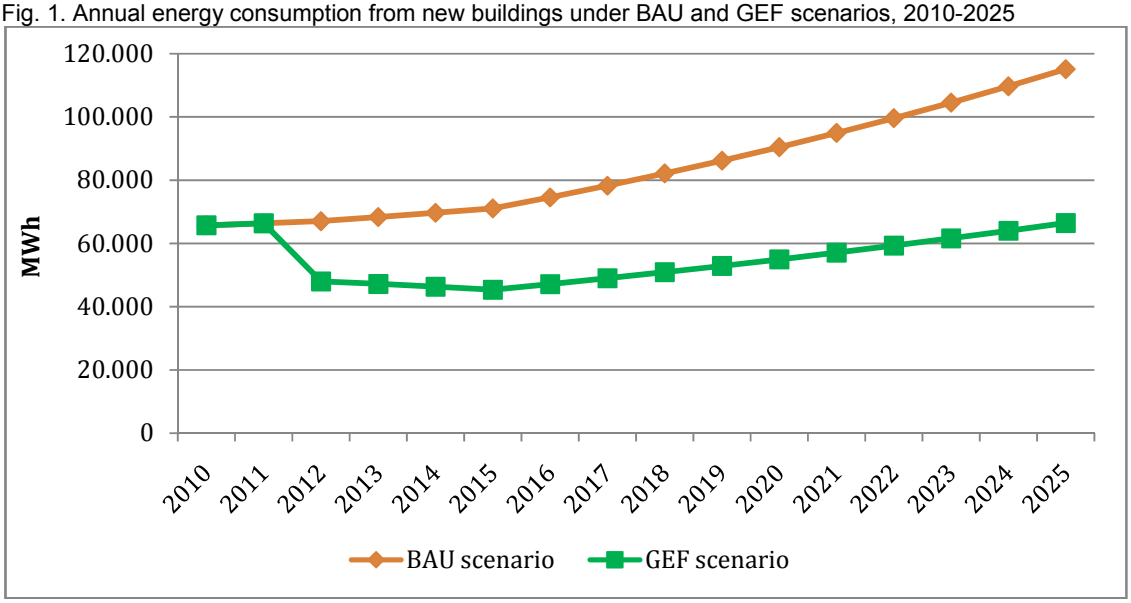
requirements in new residential buildings from the current average of 160 kWh/m^2a down to 96 kWh/m^2a by 2013.

2. **Compliance to new building codes**. Enforcement programs set up by the project would ensure the following compliance levels: by 2015, 50% full compliance, 20% minor non-compliance (energy requirement 10% above code) and 30% major non-compliance (energy requirement 50% above code) and by 2014, 70% full compliance, 10% minor non-compliance and 20% major non-compliance.

3. **Building construction volumes**: The annual construction growth was assumed to be 2% annually during the project and increasing to 6% in the post-project period. Further, the state supported program on earthquake zone restoration which envisaged commission of 460,000 m2 of new housing in 2010-2013 was also included in the calculation (building volume surveys from the National Statistical Service of Armenia from 2010 to 2015 have shown a continued general decline in annual new residential construction volumes from 520 thousand m2 in 2010 to 227 thousand m2 in 2015.)

A comparison of energy usa. ge in new residential buildings between the BAU and GEF alternative scenario from the CO_2 Emission Savings Calculation in the Project Document is shown in Fig. 1 below. The graph illustrates a dramatic drop (some 25%-40%) in energy usage in new residential buildings beginning in 2012. These energy savings which form the basis for project CO_2 ER calculations, are dependent on the quick and consequent implementation and enforcement of the new EE building codes.

Fig. 1. Annual energy consumption from new buildings under BAU and GEF scenarios, 2010-2025



Risks were not specifically addressed in the Project Document but the following project related risk categories were identified at the inception workshop;

Risk Category	Level	Status	Description	Manager response

Institut-ional	Medium	Prospective	Code enforcement will not improve sufficiently in response to project activity on training and certification in due time.	Project team would support the provision of additional incentives (real estate advertising through energy passports/labels) to the builders/developers to ensure proper enforcement.
Institut-ional and Organiz-ational	Medium	Prospective	The state construction planned in demo area might be delayed /reduced or canceled.	As the project has established good information exchange with number of private developers as well, in case the risk occurs the project will ensure enough flexibility to implement the demo component in private funded building(s) construction.
Organiz-ational	Medium	Prospective	The scheme of covering the incremental cost under the demo component might be unclear and control might be loose.	The meeting in UNDP CO Operations was organized. The organization of procurement procedure to cover the incremental cost under the Project Component 4 (demonstration of IBDA) was discussed. Further discussions will be held with representatives of the construction company to apply appropriate procurement policy.
Institut-ional and Technical	Low	Prospective	Technology and design principles demonstrated in pilot project will not be widely replicated in other state and/or private funded construction projects.	Project team has engaged key governmental agencies, including the MUD, as well as YSUAC, Architects and Builders Unions of Armenia to disseminate results, and promote replication in other buildings.

Some of the risks identified above proved valid; but more obvious risks which the project faced were first mentioned in the Mid-term evaluation and are summarized as follows;

- New energy efficiency building regulation and enforcement programs will not be approved and implemented in the project timeframe.
- Integrated Building Design Approach will not be replicated to a large extent due to missing or low capacity of architects, designers, engineers.
- Standards and norms for QA/QC of key building materials are not developed with the required effort and thus quality of materials on the market are low or incoherent.
- Non-fulfillment of project GHG ER target due to weak enforcement of EE buildings legislation and integrated design approaches in market activities

In the final months of the project, the project continued to face the high-level risk that the enforcement of new mandatory EE Building Code would not be implemented by the End-of-Project. The delay was caused by a number of factors mostly outside the influence of the Project. In particular, an initial decision on the part of IAWG to amend the existing code MSN 2.04-02-2004 'on the Thermal Protection of Buildings' in order to align to the EU Energy Performance of Buildings Directive (EPBD) has been reversed following Armenia's accession into the Eurasian Economic Union in January 2015. The Project team continued to work with IAWG to amend the MSN 2.04-02-2004 'on the Thermal Protection of Buildings' to align with current Russian SNiPs updated in 2012 to include

requirements on energy performance, auditing and passports and to adopt it to Armenian conditions. The new draft EE code was developed in close cooperation with specialists from the Ministry of Urban Development and provided to the Ministry to facilitate the adoption process which was completed in June 2016. The RA Decision 1504-N adopted December 25, 2014 'On implementation of Energy Saving and EE improvement measures in facilities being constructed (reconstructed, renovated) with state funding' incorporates key proposals developed by the Project. The decision made consideration of EE measures mandatory but still lacked formal minimum energy performance limits. Mandatory EP limits were finally set in the construction norm 'RACN 24-01-2016: Thermal Protection of Buildings' endorsed in July 2016.A risk resulting from delayed implementation of the new EE code was related to the sustainability of the project results considering weak (post-project) enforcement of the newly passed mandatory EE norms. State mechanisms to enforce capacity to enforce compliance to the EE code. Further stakeholder commitment will be necessary after the finalization of the Project to ensure enforcement bodies are identified and appropriate capacities and protocols are developed and implemented. The main ministry responsible for implementation of outcome 1 is MUD; however, MENR should maintain its coordinating role for implementation of Energy Policy of the Government, also after the project's termination.

Other risks identified in the MTE include:

- Delay in the schedule set for the pilot building construction
- IBDA does not get sufficient uptake due to lack of replication capacity
- Demonstration buildings to showcase IBDA do not have replication potential:
- Overall slowdown of construction activity and impacting GHG emission reduction estimates due to effects of international economic crisis: this risk was already evident from the actual development of construction activities in Armenia between 2009 and 2012, which showed a decline and resulting baseline energy consumption and GHG emissions being lower than expected.

Pivotal assumptions in the Project design concerning the enactment and application of new EE building codes have been realized but with significant delay. High-level risks of delays associated with the adoption of new legislation recognized in similar projects in other countries.This risk was not adequately addressed in the Project Document. While it may be true that similar projects (in Kazakhstan, Kyrgyzstan and Uzbekistan, for example) did not face extreme political shifts and were able to develop and adopt new EE codes quickly, the risk of delays in adopting EE legislation had been identified in their respective ProDocs. In this Project, there was no reference to this risk in the ProDoc. The risk of delay is first identified in the Altas Risk Log in Sept.2012 and registered as 'mitigated' in 2013 and all subsequent years even though the key legislation (the mandatory EE building code) was not endorsed until EoP in June 2016.

Lessons from other relevant projects (e.g., same focal area) incorporated into project design

The project design is in line with Strategic Objective CC – 1 "To promote energy-efficient technologies and practices in the appliances and buildings" through improved energy performance in residential (and other) buildings. The project falls under the UNDP-led *GEF Global Framework for Promoting Low Carbon Buildings* with a primary focus on two thematic approaches promoted by the Framework: a) Promotion and increased uptake of High Quality Building Codes and Standards – by introducing and enforcing mandatory

energy efficient building codes; and b) Developing and Promoting Energy Efficient Building Technologies, Building Materials and Construction Practices – by piloting integrated building design. A coordination platform offered by the global framework has helped Armenia and neighbouring countries to learn from experiences and best practices from countries with similar on-going energy-efficient building projects, including relevant GEF projects in the region (Uzbekistan, Turkmenistan, Kyrgyzstan and Kazakhstan) and good practice building codes and standards work done in other CIS countries.

The Project focuses on the development and implementation of energy performance based building codes and the introduction of Integrated Building Design. Both are relatively new concepts in Armenia, but have been introduced in other countries in the region with good results towards improving energy efficiency in buildings. Regional experience in the introduction of efficient building codes (from Russia and Uzbekistan) had shown that a broad, building energy performance-based compliance path – in which the required performance target is expressed in kWh/m² (or kWh/m3) per year, varying based on climate – was also feasible for Armenia.

The project has worked closely since the project development phase with several other relevant projects and activities, namely with the

- World Bank/GEF Project "Armenia Energy Efficiency" to exchange experience in the rehabilitation of public buildings, and the
- EU-INOGATE Project "Energy Saving Initiative in Buildings in Eastern European and Central Asian Countries" on energy policy cooperation that is promoted as key aspect of this project between the European Union and the INOGATE Partner Countries.

Results and lessons learned from other finalized projects, such as the UNDP-GEF "Improving Energy Efficiency of Municipal Heating and Hot Water Supply", or USAID funded project "Energy Efficiency and Renewable Energy Sources" have been incorporated partly in the project design or are have been made available to the project team.

A common initiative of UNDP-GEF Projects being implemented on Buildings Energy Efficiency in Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan, and Uzbekistan) and Armenia (www.beeca.net) is providing valuable inputs to the IEEB and sharing experiences among the countries. Majority of buildings in these countries do have a common history since they were built back in the Soviet times some 30-60 years ago and without energy efficiency considerations.

Planned stakeholder participation

The project was initiated and developed locally by UNDP Armenia and by local experts who were assisted by international consultants. The project received full support from project partners and stakeholders. Project stakeholders including governmental agencies and ministries, namely Ministry of Nature Protection, Ministry of Energy and Natural Resources, Ministry of Urban Development, were actively involved during the project design phase. Further consultations and coordination with other international donors active in the building sector and implementing projects with a similar or complementary focus, namely the World Bank, the European Union and USAID, played an important role in project formulation, and later in project implementation.

The joint National Executing Partners were the Ministry of Natural Protection (MNP) and the Ministry of Urban Development (MUD) as the key governmental body responsible for the development, implementation and enforcement of buildings codes and norms. As the body responsible for building in Armenia, MUD was an effective and efficient partner and assumed a leadership role.

The partnership strategy was well designed and all key local stakeholders and decision makers actively participated in Project implementation including the necessary top-level policy and decision makers, key state institutions and design organizations, universities, and other specialized expert organizations.

The primary stakeholders in this Project at the national level were;

- Ministry on Nature Protection
- Ministry of Urban Development,
- State Urban Inspectorate under the Ministry of Urban Development,
- Ministry of Energy and Natural Resources
- World Bank
- USAID/EE Energy
- European Union
- Armenia Renewable Resources and Energy Efficiency Fund
- Builder's Union of Armenia
- Architect's Union of Armenia
- Yerevan State University of Architecture and Construction
- National Institute of Standards
- Accredited laboratories for construction and construction/insulation materials QA/QC

During project implementation, further key partnerships were identified and developed including;

- European Investment Bank (EIB) in reference to the scaling-up of project impact
- Swiss Development and Cooperation Agency (SDC) as main cofinancer of the Goris Demonstration Project
- various private sector stakeholders and developers to integrate EE measures (including LEED certification of the first building in Armenia and region.)
- Asian Development Bank (ADB) in the frame of the School seismic rehabilitation project

Replication approach

The Project document explicitly referred to replicability and sustainability strategy that was based on overcoming barriers identified in the project development phase:

- **Replication of demonstration projects** accounted from market factors in place, such as locally-available materials and low-cost/no-cost design measures used. There are both demand-side and supply-side components of the replication strategy mentioned in the ProDoc:
    - On the supply side: (1) Practicing architects, who design both public and private buildings, and architecture and engineering students, that are going to be trained in IBDA techniques; and (2) Materials certification that are expected to make the energy performance of construction materials

more transparent and make it easier for architects and engineers to select materials on the basis of energy performance.
    - On the demand side: (1) Close cooperation with MUD that will increase the uptake of codes and the IBDA; (2) An awareness-raising campaign to increase the demand for buildings with lower operating costs; and (3) Stricter codes and improved enforcement will create a very strong incentive to design more efficient buildings.
- The focus on capacity building in the Project to ensure the **sustainability of project results** in the following ways:
    - Strengthening the capacity of the MUD to enact more efficient building codes and enforcing the codes to result in building energy performance to be improved.
    - Strengthening the capacity of architects and engineers to design more efficient buildings to result in cost-effective techniques that these professionals will continue to use in their businesses.
    - Raising awareness of developers, real estate professionals, and homebuyers regarding the economic benefits of more-efficient housing to result in higher demand for more efficient apartments even after the awareness-raising activities have concluded.

Both, replication and sustainability strategy were well integrated into the Project's implementation approach. Replication plays a very important role in showcasing good practice through demonstration buildings (more projects were implemented than planned) and so is the sustainability strategy that focusses on capacity building activities and awareness raising measures.

The sustainable uptake of new codes was supported by further project activities; training for building professionals and code enforcement bodies, new building energy efficiency curricula for university students and professionals, building audit, certification and labeling schemes and dissemination activities. Local capacity was developed and various pilot projects were implemented and monitored to provide a verifiable model for replication. The pilot projects were developed, designed and constructed by partnerships of local design firms and international experts to ensure the combination of international best practice with cost-efficient local design and construction practices.

Besides standard EE measures such as exterior insulation, and good thermal windows, Integrated Building Design considers such no-cost factors as compact form and layout, solar orientation, passive solar gains in winter and shading in summer and the optimal zoning of inner rooms. Integrated Building Design facilitates the realization of buildings that save long-term operation costs with minimal additional costs over standard building investments. The implementation of Integrated Building Design requires building energy

performance calculation methodologies and tools based on national construction practices and climate conditions. Further, it requires sufficiently skilled and experienced architects, designers and HVAC engineers who can coordinate from the first stages of building design in order to identify the optimal building shape, orientation, layout and EE measures to achieve high cost efficiencies.

The replication approach was well considered. The implementation of new mandatory energy efficient building codes promises long-term replication of Project results. Training

for professionals, new EE building design curricula for University students and pilot demonstrations constructed in diverse regions throughout the country support smooth uptake and replication.

UNDP comparative advantage

The project builds on UNDP's strong experience in Armenia and in Central Asia with promoting sustainable energy and environmental protection while strengthening the capacity of government institutions. UNDP involvement in Armenia has included support for strengthening the capacity of the parliament, training for civil servants, and projects related to resource use including protected areas. The UNDP Country Office in Armenia was responsible for ensuring transparency, appropriate conduct and professional auditing. Staff and consultants were contracted according to the established Rules and Regulations of the United Nations and the financial transactions and agreements similarly followed the same Rules and Regulations.

Linkages between project and other interventions within the sector

The project was initiated and developed locally by UNDP Armenia and by local experts who were assisted by international consultants. The project is in line with the strategic priority of the Armenian Government to increase the efficiency of fossil fuel use and thus ensure long-term economic and environmental stability of the country. In particular, the Project supports the amendment and implementation of the Law on "Energy Saving and Renewable Energy" (adopted on November 9, 2004) which calls for promotion of energy efficiency in buildings and constructions via development and implementation of energy examination/audit system for the existing and planned buildings and constructions.

The Project also contributes to the implementation of a number of measures stated in "Energy Sector Development Strategies in the Context of Economic Development of Armenia" (adopted on June 23, 2005), the "National Program on Energy Saving and Renewable Energy of Republic of Armenia" (adopted on January 18, 2007) and the "National Energy Efficiency Action Plan of Armenia" (adopted on November 4, 2010).

Further initiatives include

- A working co-operation with the EU-funded regional project "Energy Saving Initiative in the Building Sector in Eastern Europe and Central Asia" (ESIB project of INOGATE program) was initiated and strengthened; several working meetings with ESIB project experts and consultants were held, and consent on the joint implementation of a number of activities was reached;
- Regional Environmental Center for the Caucasus (REC Caucasus) organized an array of conferences on cleaner industrial development, greener energy sector, achievements of energy efficiency projects in Tbilisi, Georgia, at which Project's experts submitted their thematic articles and made presentations;
- In the frames of broader regional cooperation between UNDP-managed GEF-funded "Improving Energy Efficiency in Buildings" projects that currently comprise a regional network, exchange of experience is ongoing on mainstreaming advanced energy efficiency oriented approaches into the current practices of building design, construction, operation and maintenance; the Project's experts took part in a line of relevant

international events organized within the network and presented Armenia's respective achievements.

- UNDP-GEF Regional Project Team Meeting on Energy, Infrastructure, Technology and Transport was organized in Ashgabat, Turkmenistan (30.01-03.02.12). The Project's experts presented the main outcomes and findings of their Project's implementation.
- Cooperation opportunities with GEF-WB (IBRD) "Armenia Energy Efficiency Project" were discussed to avoid duplication of activities. The IEEB Project team cooperated with the WB unit on rehabilitation of the Blood Transfusion Center.
- Cooperation opportunities between the IEEB Project and Universities (YSUAC, AUA), and the Builders' Union of Armenia were discussed. Cooperation is around the awareness raising and training components of the Project. E.g., the Association of Energy Efficient Windows' Producers (APROK) of Russia jointly with the Project organized a session of their annual conference "Energy Efficient Windows-2012" in Yerevan.

Management arrangements

The project has been implemented based on UNDP's National Implementation Modality (NIM)The Project Management arrangements are as follows:

- The Project Implementing Agency is UNDP.
- The Ministry of Nature Protection and the Ministry of Urban Development were appointed to serve as Executing Agency.
- A Project Task Leader is responsible for daily management and actual implementation and monitoring of the project and is accountable to the Climate Change Program Coordinator. The project team has its project office in the premises of the Climate Change Information Center of Armenia hosted in the governmental building by Ministry of Nature Protection, i.e. outside of the UNDP country office in Armenia.
- The overall responsibility over the project is with a Project Steering Committee where ministries and governmental agencies are represented.
- UNDP Country Office Armenia is offering full support to project implementation, including administrative support as well as high level support by participation in the Steering Committee of the UNDP Resident and Deputy Resident Representatives.
- The project is implemented by MNP in cooperation with MUD and MENR , and experts who are supported by international consultants.

Short-term experts hired under the project comprised:

- International Expert on Pilot Building Design
- International Expert on Curricula Development Guidance and Advice
- International Expert on Building Codes
- Local Experts on Architecture, Design, Engineering and Building Energy Audits
- Local Experts on Legal and Regulatory Aspects, Building Codes
- Local Public Outreach Expert
- Local GHG Monitoring & Evaluation Expert

The management arrangements outlined in the project document and the qualifications specified in the ToRs were appropriate.

Project Implementation

The project was professionally managed by the Project Manager under the supervision of the UNDP Climate Change Portfolio Coordinator. Collaboration with national stakeholders was on a high level. The project and its expert team were able to position themselves as the primary source of expertise and knowledge in Armenia on energy efficiency in buildings, which has enabled them to significantly scale-up the scope and impact of their work. A project extension for 12 months (until June 30, 2016) was granted in 2015 to facilitate the completion of activities and further monitoring of energy efficient pilot projects, including those completed in 2015.

The project activities were implemented according to the annual work-plans as reviewed and approved by the Steering Committee. The regular reporting on Project implementation progress was submitted to the Executing Agency and UNDP.

Adaptive management (changes to the project design and project outputs during implementation)

The Project Inception Phase was completed by February 2011 with the recruitment of the project team, creation of the project board, organization of an inception workshop and submission of the project inception report. The project start was performed in a professional and satisfactory manner. One of the most important achievements in this regard is the development jointly with UNDP Country Office and the implementing partner of a detailed financing and procurement arrangement for pilot demonstration projects designed to avoid potential delays at later stages. The project team's proactive efforts in this respect should be commended.

The cooperation established by the project with local and international partners enabled the project to become involved in further demonstration projects. In addition to the initially planned pilot building in Akhuryan village, the demonstration component was expanded to include a social multi-apartment building in Goris town, a residential building rehabilitation in Avan and several others. Based on the success of these projects, the project managed to leverage additional co-financing including the follow up US$120 million GCF/EIB Project.

In the first year, It was recognized as crucial that any update of building codes take into account the most recent developments/updates and amendments to be introduced by CIS interstate scientific-technical council on standardization, technical norms and certification in construction.

The Project team translated and adapted the EU EPBD and submitted it to the Ministry of Energy and Natural Resources, while its supporting standards were translated and approved by the order N40-V of September 17, 2014, of National Institute of Standards CJSC of the Ministry of Economy and enacted on November 1, 2014. The National Standard on Building Energy Passport was approved by National Institute of Standards on November 12, 2013 (registration ID: AST 362-2013). To enable enforcement of mandatory energy efficiency requirements, the Project helped develope the a new EE technical standard Technical in which Building Energy Performance requirements are set. The Norm RACN 24-01-2016: Thermal Protection of Buildings' was enacted in June 2016.

Apart from the new EE building code, the Project identified and developed other key legislation including;

- The RA Decision 1504-N adopted December 25, 2014 'On implementation of Energy Saving and EE improvement measures in facilities being constructed (reconstructed, renovated) with state funding'. The decision made consideration of EE measures mandatory in publicly funded buildings and renovations. This includes construction under the New Schools Programme financed in part by the Asian Development Bank which will build some 1400 new schools throughout Armenia. According to statistical data, the more stringent standards affected the construction of some 29250 m2 of new or renovated state-funded buildings in 2015 and the first half of 2016. These requirements will continue to generate impact in the post-project period.
- Draft RA Law 'on making an amendment and an addition into the RA law 'on energy efficiency and renewable energy' which prepares the basis for mandatory EE requirements in the building sector.
- Draft RA Law on making an addition into the RA law 'on urban development' which prepares the basis for mandatory EE requirements in the building sector.
- Several technical regulations and norms including 'buildings, structures, construction materials and pre.fabricate. Safety', 'thermal networks' and 'thermal insulation of equipment and pipes'
- 6 standards for calculation of building energy performance based on EU norms
- The National Standard AST 362-2013 Energy Efficiency. Building energy passport. Main Provisions. Typical Forms.

In its final year, the project developed and initiated a comprehensive 'exit strategy' in the form of the US$120 million Green Climate Fund/ European Investment Bank Project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits.' The project was developed by the IEEB project based on the success of pilot EE retrofits in the residential sector. This follow-up project builds on and strengthens the long-term impact of the Project. The first phase of the 20-year project was initiated in Yerevan in 2016.

Partnership arrangements (with relevant stakeholders involved in the country/region)

In addition to establishing excellent partnership relations with the national counterparts, the project team made significant progress in collaborating with EU-funded regional initiative on energy efficiency in buildings and a few other donor- and private sector funded projects in construction sector in Armenia. The new partnerships opened the project to expand the scope of its work to cover more demonstration buildings and strengthen its work on introduction of energy passport system with additional expertise and experience via EU-funded activities.

Already in the first years of the Project, the team was able to establish partnerships with;

-Syunik Regional Administration and the Swiss Development and Cooperation Agency to construct an EE social multi-apartment building in Goris town; and
- with Ministry of Urban Development of the RA and "Glendale Hills" CJSC (developer) to ensure EE measures implementation in multi-apartment building under construction.
- Further, a cooperation with the EU-funded regional project "Energy Saving Initiative in the Building Sector in Eastern Europe and Central Asia" (ESIB project of INGATE

program) was strengthened, agreed upon and a work plan of joint implementation activities was reached (cooperation matrix).

Consultations were held with Armenian Association of Real Estate Developers and with Builders Union of Armenia and Union of Architects of Armenia. The energy performance of the completed demo building in Goris town was closely monitored by the Project with the active participation of the residents to the higher mutual benefit. Cooperation with the American Missionary Association of Armenia a helped realize a new LEED certified school in Malatia district of Yerevan city.

The project cooperated closely with Shincertificate LLC, where a new testing and certification laboratory was opened and equipped with support of the Project. Local manufacturers were granted technical certificates for their products and continue cooperation with the certification body/testing laboratory.

Based on the Project's specific experience and drawn expertise, continuous consultations are delivered to the Small Grants Project on building energy efficiency related issues as they come up in some of the small projects (including a Kindergarten). Advantages of integrated building design are demonstrated in high school project in Marts community of Lori marz, constructed by MUD PIU in the frame of state programme.

Following success of Avan pilot, Yerevan city Municipality cooperated with the Project in in up-scaling initiatives based on the successful completion of thermal retrofit of the selected residential building. The Ministry of Urban Development and UNECE cooperated with the Project for development of Armenia Housing Country Profile and Goris Smart City Concept. The Project consulted UNDP project on 3 border crossing points on enhancing the energy performance of their newly designed and built buildings.The project consulted the implementation unit of the World Bank on selection of insulation materials and techniques for reconstruction project of Republican Blood Transfusion Center. Consultations with National Institute of Standards CJSC continue, particularly, as the follow-up of the technical specifications development, expertise and registration. According to the agreed approaches, cooperation with EU funded Energy Saving Initiative in Building Sector project, including joint event organization and consultations. Yerevan State University of Architecture and Construction and State Engineering University of Armenia support the educational activities of the Project and ensure that their faculty and staff benefit from them. Good cooperation with the American University of Armenia was maintained throughout the project.

This Project benefited greatly from the support of many government agencies and organizations. Recognizing that bureaucracy can be a very complex barrier in projects involving several ministries and striving for legislative changes, this project has benefited from the continuing commitment of government partners.

The Project was implemented mainly by local experts and key local institutions. International project consultants provided advice and experience on best international practice, whereby the actual project deliverables (energy efficient building codes, design of new and reconstructed buildings, educational curricula etc) were developed by local experts with good experience in the workings of the key organizations.

The partnership strategy has been well implemented and all key local stakeholders and decision makers have actively participated in project implementation including top level policy and decision makers, key state institutions and design organizations, universities, and other specialized expert organizations.

Feedback from M&E activities used for adaptive management

Monitoring of project targets was well applied during implementation from the beginning of the project onwards. UNDP and the Project Management Unit were organized, goal-oriented and pro-active in the recognition of possible problems and opportunities and in developing alternative action plans throughout the implementation of the Project.

The Project implementation was overseen by the Project Steering Committee which met once a year. At Project Steering Committee meetings, the Project team presented achievements to date and a draft work plan for the following year. The national partners and stakeholders were required to review and approve the work plan.

The Mid-Term Evaluation of the project took place in 2013. Recommendations in the Mid-term Evaluation were considered by the Project team and Steering Committee. Recommendations included:

1: Legislation: focus is needed to achieve adoptions of new Armenian EE Building Code

2: Ensure that institutional bodies to take EE forward into the market are created

3: Initial project structure needs slight adaptations:

Some of the targets given under initial Project Results Framework (ProDoc) were revised in regard to their expectations and timing. A review of the logframe was performed and was amended accordingly as a result of MTE findings and for approval of the SC.

4: Monitoring of GHG emission reductions to be followed-up and results visualized:

- A detailed methodology should be developed for energy and GHG monitoring of the remaining project period.
- The energy and GHG monitoring should be continued after project termination through a suitable public entity.
- Dissemination of evaluation results and benefits achieved is a key to further attract attention of other building owners and developers/investors.

5: Maintain high level of public outreach and institutionalize public awareness measures in the long term.

In 2015, a no-cost extension was approved by the Project's Steering Committee. Under the first component, the Project found alternatives and supplementing solutions to support the strengthening positions of energy performance upgrade practices in legal and regulative framework of the country. At the EoP, all the Project's key developed and circulated law amendments, standards, methodologies etc. have been successfully adopted by Government.

Project Finance:

The project benefited from the previous experience of both Project Manager and Administrative/Financial assistant with UNDP projects. The financial implementation of the project was well managed and administered. Random reviews of financial records shows orderly and well-administered records.

Table 1 compares the original project budget as outlined in the project document with the actual (and expected final) dispersions based on the Combined Delivery Reports. It should be noted that due to a change in UNDP accounting standards (from UNSAS to IPSAS), expenditures totalling $57.934,10 were accounted in both the 2011 and the

Table 1 - Project Budget and Dispersements

Project Document			Dispersements according to Combined Delivery Reports									difference between budget and dispersements	
GEF Outcome / Atlas Activity	**Budget (USD)**		2010	2011 *	2012 *	2013	2014	2015 **	2016 **	**Project TOTAL**			
Outcome 1	**137.000**	11%	22.770	36.990	51.599	34.505	22.212	4.950	3.000	**176.027**	14%	39.027	28%
Outcome 2	**140.000**	12%	0	14.381	59.459	40.390	11.615	3.150	0	**128.994**	10%	-11.006	-8%
Outcome 3	**180.500**	15%	3.016	27.361	89.804	61.334	43.264	16.056	3.000	**243.835**	19%	63.335	35%
Outcome 4	**600.000**	50%	28.104	110.950	78.647	196.174	35.871	70.034	51.000	**570.781**	46%	-29.219	-5%
Proj. Man.	**137.500**	12%	6.624	28.880	33.033	29.661	20.298	9.800	5.000	**133.297**	11%	-4.203	-3%
TOTAL	**1.195.000**	100%	**60.515**	**218.562**	**312.543**	**362.064**	**133.261**	**103.989**	**62.000**	**1.252.934**	100%	**57.934** *	5%
			5%	17%	25%	29%	11%	8%	5%	100%			

* due to a change in UNDP accounting standards (from UNSAS to IPSAS), expenditures totalling $57.934,10 were accounted in both 2011 and 2012, artificially increasing the total project dispersements by this amount

** Dispersements for 2015 and 2016 are still predicted expenditures based on AWP Budget revision May 2015

Table 2 - Cofinancing

Co-financing (type/source)	UNDP own financing (mill. US$)		Government (mill. US$)		Partner Agency (mill. US$)		Total (mill. US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants	0.15	0.15	2.0	2.0			2.15	2.15
Loans/Concessions								
• In-kind support			0.2	0.2			0.2	0.2
• Other						12.1		12.1
Totals	0.15	0.15	2.2	2.2		12.1	2.35	14.45

2012 Combined Delivery Reports, artificially increasing the total project dispersements by this amount (from $1,195,000 to $1,252,934.) Although final Combined Delivery Reports for the years 2015 and 2016 are not yet available, it is expected that project will spend the remaining available funding (about 166,000 USD or 13% of the total project budget) to cover the expenditures of the final year and a half of the project. A preliminary Combined Delivery Report for 2015 already indicates total expenditures of $85,587,76 for that year leaving just some $79,500.- to cover all expenditures in 2016.As seen in Table 1, project dispersements are close to the budget breakdowns set out in the Project Document. Over the project lifetime, some funding was shifted, specifically from Outcomes 2 and 4 to cover additional expenditures in Outcomes 1 and 3. The total amounts shifted account for some 10% of the total budget.

Project co-financing has amounted to an estimated USD 14.45 million following the actual project implementation status, with details from project partners provided in the Table 2. This is a significant acheivement at 7 times higher than the target

The Project has benefited from additionally leveraged resources of about USD 0.5 million from the Swiss Development Agency for the residential demo building being built in Goris city and private sector cash-contribution from the building developer Cascade Hills – Al Hamra Real Estate Development Armenia (USD 2.4 million) and USD 4,700 from Shincertificate LLC.

Monitoring and evaluation: design at entry, implementation and overall assessment

The Project was subject to standard UNDP monitoring and evaluation procedures. Project planned activities and achievements were regularly reported and approved by the Project Steering Committee. Annual Work Plans, Annual Progress Reports, and Project Implementation Reports are regularly developed and submitted for approval.

Monitoring of overall project targets was well applied during implementation from the beginning of the project onwards. UNDP and the Project Management Unit were organized, goal-oriented and pro-active in the recognition of possible problems and opportunities and in developing alternative action plans throughout the implementation of the project.

a Project Steering Committee (PSC) was established according to the ProDoc with 11 members nominated by the corresponding agencies: MNP, MUD, MENR, ME, UNDP, UNIDO, Armenia Renewable Resources and Energy Efficiency Fund (R2E2), Yerevan State University for Architecture and Construction (YSUAC), and the Builders Union of Armenia (BUA).

Steering Committee meetings of the Project were held annually. Analytical reports on the Project's performed activities were presented and endorsed by the Committee. Work plans were reviewed, discussed and approved according to recommendations from the Steering Committee. Meeting minutes (in Armenian) and Analytical Reports are available on the project website.

The project activities were implemented according to the annual work-plans as reviewed and approved by the Steering Committee. The regular reporting on Project implementation progress was submitted to the Executing Agency and UNDP.

The Ad-hoc Inter Agency Working Group (IAWG) was established by the order of the Minister of Urban Development in November 2010, comprising from nominees from the:

MUD, MNP, MENR, ME, BUA, YSUAC, R2E2, "Glendale Hills" CJSC (pilot area builder) chaired by the Deputy Minister of Urban Development. The IAWG was the body to support the inter-agency co-operation in developing construction norms and regulations for the use of modern energy-efficient construction technologies and construction materials and their mandatory enactment, as well as building professional skills and capacities for introducing the construction principles in the design of energy efficient buildings (from the design phase up to the construction and exploitation phase). The Project benefited from this working group since a regular communication basis was maintained among stakeholders to discuss the proposed legal-regulatory changes aiming at improving energy efficiency in the building sector.

The Mid-Term Evaluation took place in 2013.

The Terminal Evaluation has taken place from February to August 2016

Monitoring and evaluation has been implemented according to the GEF/UNDP practice and in line with the monitoring and evaluation plan described in the Project Document.

The project results were regularly reported to UNDP and GEF on an annual basis [UNDP Annual Project Reviews (APRs), and GEF Project Implementation Reviews (PIRs)].

Based on the review of all available information, overall monitoring and evaluation was rated satisfactory.

HS	S	MS	MU	U	HU	N/A
	X					

Implementing Agency (UNDP) execution (*) and Executing Agency execution (*), overall project implementation/ execution (*), coordination and operational issues

The UNDP Country office was actively involved in Steering Committee meetings, stakeholder working meetings, the inception workshop and various cooperation discussions/negotiations to get the project off to a smooth start and to ensure its effective operation. As an active member of the Steering Committee, UNDP reviewed, discussed and endorsed project activities and annual work plans.

Based on the review of all available information, the Implementing Agency (UNDP) execution was rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

The joint National Executing Partners were the Ministry of Natural Protection (MNP) and the Ministry of Urban Development (MUD) as the key governmental body responsible the development, implementation and enforcement of buildings codes and norms. As the body responsible for building in Armenia, MUD was an effective and efficient partner and assumed a leadership role. Both Ministries were active. Within the first year, an Inter-Agency Working Group was formed under the Ministry of Urban Development to advise on the new energy efficient building codes and corresponding legal acts development/adaptation

Based on the review of all available information, the Executing Agency execution was rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

The project was professionally managed by the Project Manager under the supervision of the UNDP Climate Change Portfolio Coordinator. Collaboration with national stakeholders was on a high level. The project and its expert team were able to position themselves as the primary source of expertise and knowledge in Armenia on energy efficiency in buildings, which has enabled them to significantly scale-up the scope and impact of their work.

The implementation of the project components was organized and managed under the leadership of the Project Manager, Vahram Jalalyan. The project manager has contributed strong leadership, management and strategic planning skills. The strong motivation and initiative exhibited by his and his team contributed greatly to the project's efficient realization.

Based on the review of all available information, the overall project implementation/ execution was rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

Project Results

Overall results (attainment of objectives) (*)

Project objective: Reduce GHG emissions and energy consumption in the Armenian residential building sector.

SUCCESS CRITERIA (FROM LOGFRAME)	ASSESSMENT
Average thermal energy consumption for space heating in new residential buildings in Armenia **reduced by 40%** from 185kWh/m2.a to 111kWh/m2.a. (in the Prodoc from 165kWh/m2.a to 96kWh/m2.a but adjusted at MTE)	Monitoring data from the eight pilot buildings/renovations developed under the project in the residential and government building sectors have demonstrated energy savings in the range of 25-60%. Under the project, legislation has been developed and enacted which form the legal basis for application of new EE building standards. Construction norm 'RACN 24-01-2016 Thermal Protection of Buildings' enacted in June 2016 sets mandatory energy performance limits for new and rehabilitated buildings – both private and public.
Approx. **60 kt CO_2 ER** from new residential buildings built during project lifetime.	The eight pilot sites (residential and public buildings) realized under the project in total contribute **12.5 ktCO2 direct ER** (including 20yr lifecycle). Due to a delay in realizing the new EE building code, the ER from the mandatory application of this code to new residential buildings are all **post-project direct; 159 ktCO2 ER** are expected. In the public building sector, mandatory EE requirements (since Dec.2014) account an additional **26.5 ktCO2 direct ER** and **136.7 ktCO2 post-project direct ER**

The overall success of the project was highly dependent on the implementation of a new mandatory EE building code. Several supporting laws and standards were enacted under the project, the delay in adoption of the key technical regulation which sets mandatory energy performance requirements for new and renovated buildings, the updated MSN 'on the Thermal Performance of Buildings' was delayed. During the final months of the project, this regulation was updated to harmonize with Russian standards following Armenia's accension into the Eurasian Economic Union in 2015. The MUD endorsed the updated version in June 2016. The monitoring of the energy performance of the 8 pilot buildings implemented under the project has provided reliable source data on energy savings for these buildings. National statistical data on new residential building volumes, have shown a general decline over the project implementation period (from 520 thousand m2 in 2010 to 227 thousand m2 in 2015) which was not forseen at the project start. A lack of data on the actual (voluntary and mandatory) application of the EE measures and methodologies introduced by the Project, makes an assessment of the emission reductions attributable to the Project somewhat difficult. Further, accountable CO_2 emission reduction calculation protocols for direct and post-Project impact (GEF GHG tracking tool) were applied only after EoP. The recommendation that an accountable tool should be applied was already brought up in the Mid Term Evaluation Report.

Component 1 – Design and enforcement of new EE building codes and standards.

SUCCESS CRITERIA (FROM LOGFRAME)	**ASSESSMENT**
By end of project, **new codes adopted**, setting mandatory energy performance targets comparable with MSN/EU standards	The component has been successfully achieved but with significant delay. Under the Project, legislation and standards have been developed and enacted which are the legal basis for application of new mandatory EE building standards. The mandatory EE building code (the updated MSN 'on the Thermal Performance of Buildings' was enacted in June 2016. . During the final Evaluation, a package of legislation amendments in the Laws of the Republic of Armenia drafted by the project were circulated and adopted by the Ministry of Energy and Natural Resources and Ministry of Urban Development including: -On making an amendment and an addition into the RA law 'On energy efficiency and renewable energy'; -On making an addition into the RA law 'On urban development'; -On developing the smaller center of Yerevan (was included in the National Assembly session on 14 March 2016.) The project ensured the inclusion of energy efficiency mandatory and voluntary provisions in the Law on Smaller Center of Yerevan City. In particular, the minimal energy performance of 80 kWh/m2 year,. Technical regulation on safety of buildings, constructions, materials and prefabricate have been approved. Harmonization of EU building energy performance directive

	and supporting six standards is elaborated; the standards are approved by the order N40-V of September 17, 2014, of National Institute of Standards CJSC of the RA Ministry of Economy and enacted on November 1, 2014. Based on the EU Directive the Technical regulation on buildings' energy efficiency is developed, circulated within stakeholders and submitted to the Government for approval. Energy rating standard "Green building. Buildings and Civil Construction. Rating Evaluation of Sustainability in Building Construction" has been translated into Armenian, Ministry of Urban Development of Armenia as a signatory of Interstate Building Code on Thermal Protection of Buildings is still waiting the updated document to be provided from Intergovernmental Scientific-technical Commission for Construction for consideration. The charter of the Ministry of Urban Development was amended with provisions on ensuring the energy efficiency in construction sector according to the draft proposed by the Project. Amendments to the RA Law 'on Energy Efficiency and Renewable Energy' prepared and passed during the final months of the project include the mandatory application of new EE building standards developed under the project to all state-funded new building/renovations creating the legal basis for substantial and sustainable direct post-project ER.
By the project mid-term, **audit protocols** are in place By the end of the project, audits are carried out in at least 50% of new buildings and buildings undergoing capital reconstruction	National standard "Methodology for performing energy audit in residential and public buildings" was drafted and submitted to the National Institute of Standards for audit and registration, passed the "Energy sector" technical commission and enacted on April 1, 2016 (registration ID: AST 371-2016). Audits have been carried out according to the methodology on 15 buildings.
By the project mid-term, guidelines for **energy passport** are drafted and approved By the end of the project, energy passports provided for at least 50% of new buildings and buildings undergoing capital reconstruction.	National Standard "Energy Efficiency. Building energy passport. Main provisions. Typical forms" was drafted and submitted to the National Institute of Standards for audit and registration, passed the "Energy sector" technical commission and enacted on January 1, 2014 (registration ID: AST 362-2013). Energy passports for 15 buildings have been prepared under the project based on this standard.

Increase capacity of the MUD inspectorate and independent technical supervision bodies to implement and check compliance with energy efficiency codes. By project mid-term, **code enforcement** program in place. By end of project, revision process for codes carried out or underway. By end of project, code enforcement program reaches 50% of new and reconstructed buildings.	Energy efficiency related legal and institutional improvements in urban development sector as developed by the Project's experts are included into a number of legislative amendments approved by the Government, certain amendments are under consideration. Energy efficient solutions for building envelopes are promoted via recommendations included in the Handbook of technical solutions (adopted by the order #343 of the Minister of Urban Development of November 6, 2013) and disseminated among project beneficiaries. Professional literature was procured and disseminated among sector professionals and relevant universities, including the database on insulation materials (developed and published) and the updated code on building climatology (published). Due to lack of revised EE building codes, the code enforcement program has not been implemented.

New mandatory EE building legislation is a key outcome of the Project supporting long-term sustainable impact. Market growth of EE building sector was largely dependant on the successful introduction of new mandatory energy performance requirements and energy passport system for residential buildings in Armenia. Government Decision 1504-N 'On implementation of Energy Saving and EE improvement measures in facilities being constructed (reconstructed, renovated) with state funding' from Dec. 2014 and the new EE construction norm 'RACN 24-01-2016 Thermal Protection of Buildings' enacted in June 2016 both introduce new mandatory minimum requirements for the construction sector.

Further, the set of measures for legal and institutional improvements required for strengthening and development of energy efficiency approaches in urban development sector, as developed by the Project experts, have been selectively included into a number of legislative amendments. These include Draft RA Law 'On making an amendment and an addition into the RA law 'On energy efficiency and renewable energy', Draft RA Law 'On making an addition into the RA law 'On urban development', and draft RA law 'On developing the smaller center of Yerevan'.
The adoption of the mentioned Law 'On making an amendment and an addition into the RA law 'On energy efficiency and renewable energy' enables the following:
- Besides voluntary principle for actors in the energy saving sector also application of compulsion so as to create legislative basis of stipulating energy efficiency requirements on buildings and lighting equipment/lamps in legal acts (e.g. via adoption of the respective technical regulations);
- Stipulating mandatory requirements on energy efficiency and energy saving for the newly constructed residential multi-apartment buildings as well as for facilities being constructed (reconstructed, renovated) under the state funding;
- Identification of economy sectors of the Republic of Armenia as featuring high, medium and low energy intensity which will enable to implement regular organizing of statistics on energy consumption in buildings;

- Adoption of labeling of energy consuming equipment and devices and identification of label form to contribute to wider use of those (including lamps and lighting equipment) in buildings, outdoor lighting and other systems;
- Clarification of regulatory issues for energy audit implementation;
- Compilation of a list of energy efficient devices, appliances and other products identified as hazardous for human life and/or environment (containing dangerous substances), as well as procedure for circulation of those in the RA internal consumer market and utilization of those upon disposal, including issues relevant to mercury containing lamps.

As requested by the Ministry of Energy and Natural Resources, EU building energy performance directive (EPBD) and supporting six standards were harmonized, circulated among specialized organizations and experts for comments and recommendations, further amended accordingly, then approved by the order N40-V of September 17, 2014, of National Institute of Standards CJSC of the RA Ministry of Economy and enacted on November 1, 2014. Draft technical regulation 'On Building Energy Performance' elaborated on the basis of EPBD, was amended taking into consideration the comments and recommendations of Inter-Agency Working Group members on the session of July 29, 2014, and submitted to the RA Ministry of Energy and Natural Resources for further official circulation. Discussions were held with the National Institute of Standards to decide on form and status of normative documents developed in the frames of the project, i.e., buildings energy audit methodology (with key stakeholders' comments considered) and energy rating standard for buildings based on the statement of intent between UNDP and 'Armenian association of developers' NGO. Standard on "Green building. Buildings and civil construction. Rating evaluation of Sustainability in building construction" was translated into Armenian, localization underway.

Six key standards developed by the project were approved by the order of 17.09.2014 of National Institute of Standards CJSC of the Ministry of Economy and enacted on 01.11.2014:

- EN ISO 13790: Energy performance of buildings – Calculation of energy use for space heating and cooling
- EN ISO 13789: Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method
- EN ISO 10211: Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations
- EN ISO 14683: Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values
- EN 15242: Ventilation for buildings – Calculation methods for the determination of air flow rates in buildings including infiltration
- EN ISO 9251:1996: Thermal insulation – Heat transfer conditions and properties of materials – Vocabulary

The standards were designed taking into account climatic, technical and demographic data.

National standard AST 362-2013 "Energy efficiency. Building energy passport. Main provisions. Typical forms" was developed by the Project's expert team in 2013 and registered in accordance with the current procedures by the National Institute of Standards (SARM) on December 18, 2013 (registration ID: AST 362-2013). The standard was enacted on January 1, 2014. The standard is one of the main normative documents setting buildings' energy performance requirements. The standard

contributes to introduction and strengthening of energy passport application of residential and public buildings aiming at improved energy performance in buildings. Based on the adopted standard, energy passports for 15 residential buildings were compiled in the frames of the Project.

National standard AST 371-2016 "Methodology for performing energy audit in residential and public buildings" was developed by the Project in 2014-2015 and registered in accordance with the current procedures by the National Institute of Standards (SARM) on 16.03.2016 (registration ID: AST 371-2016). The standard was enacted on 01.04.2016. The standard is one of the main normative documents regulating procedure for performing energy audit in residential and public buildings, preparing building's energy passport and based on the latter defining building's energy efficiency class.

Calculation tool for assessment of energy efficiency performance of buildings was developed based on the above-mentioned methodology.The tool is available for downloading from the Project website and will be useful for different users such as architects, engineers, energy auditors, property managers, policy makers etc.

Component 2: Quality control, testing and certification of EE materials and equipment

SUCCESS CRITERIA (FROM LOGFRAME)	**ASSESSMENT**
By end of project, at least one laboratory can perform testing and certification of domestic and imported construction materials such as insulation, windows, doors, and heating systems.	The Project supported the establishment of 2 new testing laboratories for insulation materials. The opening ceremonies of both laboratories was held in March 2013. 1. An educational/testing laboratory was equipped in the Yerevan State University of Architecture and Construction. 2. Shincertificate LLC has been set up as a private sector testing laboratory and certification body.
By end of project, domestically-produced EE materials comprise at least 10-20% of the market.	To ensure the market share of certified domestically produced insulation materials and prefabricates, the Project: i) supported testing and certification of 4 eligible local insulation products; ii) supported development of 6 technical specifications and their registration in the National Institute of Standards for local producers and importers of materials; iii) handed conformity certificates to 8 eligible local insulation products and materials; iv) distributed the developed Database of Locally produced and Imported Construction and Insulation Materials available in local market (Armenian and English, 2013). According to market survey domestically-produced energy efficient/insulation materials comprise about 45% of local market which is twice the target

The laboratory of Shincertificate LLC has been successfully equipped and set up by the Project to perform testing and certification of construction insulation materials produced in and imported to Armenia. With financial support from the Project, technical specifications for Insulating blocks (TP AM 48883777.7332-2014) were developed by the National Institute of Standards CJSC and the respective producer was certified in

compliance with requirements of the technical specifications Shincertificate LLC in accordance with Letter of Intent signed with UNDP Armenia. A manual on instrumental measurement of thermal technical parameters has been developed and approved by the National University of Architecture and Construction of Armenia Foundation for organization of practical lessons on application of the equipment and instruments procured. The manual is published and distributed.

Component 3: Outreach, training, and education

SUCCESS CRITERIA (FROM LOGFRAME)	**ASSESSMENT**
By end of project, all graduating architecture and civil engineering students with an emphasis on residential buildings are aware of IBDA concepts.	In 2011, Seminar/presentation on IBDA was organized for the Yerevan State University for Architecture and Construction with participation of international expert. About 20 lecturers and 40 Masters and PhDs participated. Over 90 students were trained: i) during trainings and workshops on integrated building design approach, building codes and construction materials certification issues organized, in Yerevan State University of Architecture and Construction. ii) within a 6-day Summer Extension Course on Solar Architecture jointly organized with American University of Armenia. iii) students of American University of Armenia and sector specialists were trained by an invited expert, an international board member of the US Building Commissioning Association on Sustainability, Leadership in Energy and Environmental Design (LEED) The complete set of ten educational modules on energy efficiency in buildings are developed (in Armenian and in English), compiled as a biligual textbook on Green Architecture and already included in the curricula of the respective Universities (confirmation letter received) and published.
By project mid-term, key experts at design institutes & in academia are using IBDA concepts.	About 180 sector professionals were trained during: i) study tour to Prague for Project stakeholders from Ministry of Urban development and Yerevan Municipality. ii) training for 40 sector professionals on building insulation techniques. iii) trainings and workshops on integrated building design approach, building codes and construction materials certification issues. iv) study tour on construction and insulation materials testing and certification in Research Institute of Building Physics, Moscow. v) study tour on materials testing and certification in companies of Germany. vi) Training of developers on voluntary rating standard and energy passports/energy efficiency labels for buildings in Armenia.
By end of project, at least 4- 5 % of buildings constructed annually apply IBDA	8 demonstration projects applying IBDA were completed under the Project. Further, under Government Decision 1504-N 'On implementation of Energy Saving and EE improvement measures in facilities being constructed (reconstructed, renovated) with state funding' from Dec. 2014, government

	funded construction is required to apply IBDA principles.
By project mid- term, a majority of real estate professionals are aware of the potential benefits of energy efficient buildings and understand the energy passport and label. By end of project, at least 10% of new residential building stock is marketed with energy passports and labels	15 energy audits were conducted in residential buildings, from which 6 energy audits were performed based on instrumental measuring. Energy passports developed. Series of three social ads (prepared in 2013) were amended with subtitles and broadcast via LED displays in Yerevan (in cooperation with Yerevan Municipality). 2 documentaries on Energy Efficiency: Saving and Comfort focusing on building energy efficiency situation in Armenia and Project activities and on opening of social demo building in Goris town were prepared, broadcast and shared on web. Two newspaper articles on demonstration building in Yerevan city, one - on locally produced insulation materials certification were published as was an article on testing and certification laboratory established. Several coverages of the story of pilot project in Avan were produced by local and international TV and media and Yerevan city municipality as the project's key partner. Thematic calendar and other promotion materials designed and published.

A complete set of ten educational modules (400 pages) on energy efficiency in buildings were developed (in Armenian and in English), compiled as a textbook on Green Architecture to be further included in the curricula of the respective Universities (confirmation letter received) and published. Transfer of Czech Experience project on Energy Efficiency in Buildings was co-financed by Czech Trust Fund, with a study tour to Czech Republic in late June 2014 with participation of key stakeholders and in-country training in October 2014 - on EU relevant legislation, Czech standards of energy efficient buildings, and enforcement of energy efficiency requirements, experience and quality control. A seminar was held for the staff of State Urban Development Inspectorate of the RA Ministry of Urban Development on July 31, 2014, to discuss the legal-normative framework of urban development sector. In the frames of the International Day of Energy Efficiency: (1) in cooperation with the Union of Architects of Armenia and Green Urban Lighting UNDP-GEF Project, a seminar for architects, designers and other stakeholder parties was organized on November 14, 2014; (2) an awareness raising event was delivered for about 50 secondary school students of Yerevan city focusing on building energy performance issues.

Further, the Project actively participated in the following:

- Forum on "Smart cities of the future" organized in Moscow, Russia, 2015. Project achievements were presented to the international audience.
- "ENES EXPO 2016" (11,000 participants event), in Moscow, Russia. Project results presented.
- Project held a leading proactive role in promoting Armenia as a venue and in organizing the Sixth International Forum on Energy for Sustainable Development held by the UNECE, UNDP, Government of Armenia and other UN agencies in Yerevan, Armenia in September 2015.

Component 3 – training and education programs - has been professionally and timely implemented. The programs and curricula for university students and graduates on

energy efficiency in buildings have been developed, approved and effectively implemented.

Component 4: Demonstration of integrated building design

SUCCESS CRITERIA (FROM LOGFRAME)	**ASSESSMENT**
By project mid-term, the building design is completed and approved by the developer and MUD. By end of project, demonstration building showing at least 30% better thermal performance that the improved code and 60% better than the existing code	**Pilot project in Goris city:** Energy performance of the Goris pilot building was reduced from 216kWh/m2 year in baseline design to 82 kWh/m2 year Energy performance was improved by more than 60%. Calculated incremental cost was equal to 8-9% from cost of construction. The building was monitored for 2 heating seasons. Based on the success, the Project supported design and construction of a total of 8 pilot sites using Integrated Building Design Approach, in particular: i) 1 school using Leadership in Energy and Environmental Design, ii) 1 multi-purpose building using BREAM certificate scheme, iii) a 8 building residential complex in Yerevan,iv) Pilot EE renovation (60% energy savings) of a typical nine-storey panel building (36 apartments) in Avan,Yerevan Designs of five replicable (typical) energy efficient individual residential houses for communities of Armenia and respective catalog were approved by Ministry of Urban Development, published on Ministry, Yerevan Municipality and Project websites, printed and distributed over Armenia.

Based on the proven success of the Project's pilots, especially thermal retrofit of operating residential building in Avan, a scaling-up of the project's pilot component took place. The project included the following additional demonstration;

- Cooperation with Hamra Real Estate Armenia LLC constructing Cascade Hills residential complex in Yerevan city in accordance with the energy efficient solutions proposed by the Project experts and monitored accordingly.
- In the frame and agreement with the Armenian Missionary Association of America (AMAA) the Project supported the procuring thermal insulation and assistance was provided to design and construction of LEED certified green building of school erected in Malatia administrative district of Yerevan city. The building opened in October 2014.
- Measures for energy efficiency improvement of "Meghvik" child care center in Gyumri city were implemented jointly with USAID. In particular, the building's roof was completely thermally insulated, light-penetrating solutions were developed and applied to the hall with a high ceiling and infrared heaters were installed in the hall.
- Support to the design of energy efficient replicable "Kindergarten and elementary school" complex. A project implemented by "Dar" Foundation, is aimed at design and construction of "Kindergarten and elementary school" complex in Tsaghkunq

community of Gegharkunik marz with application of modern energy efficient technologies and materials. In 2014, a Statement of Intent was signed between "Dar" Foundation and UNDP Armenia enabling provision of technical assistance and consultations to design team to ensure enhanced energy efficiency and energy saving of the building. The building's design is envisaged for replication as a typical one in other settlements in Armenia.

The project progress overall can be considered as highly satisfactory and in line with project document for all 4 components. Under Components 1 Construction norm 'RACN 24-01-2016 Thermal Protection of Buildings' was enacted in June 2016 setting out mandatory requirements on building energy efficiency. The project has cooperated with private sector: construction materials testing laboratories; insulation materials producers; real estate brokers, residential building developers, design institutions. Two laboratories, equipped by the Project midterm, are operational and contribute to the sector development. Market share of tested and certified insulation materials have increased.

During the early years of implementation the Project went beyond the planned activities under the Components 2 and 4, enabling up-scaling of its pilot component. The sustainable impact of pilot projects is evident: first, the private sector is already picking up as experience in project collaboration with various developers and second the EE retrofit pilot opened the path for the US$120 million GCF/ EIB project: De-Risking and Scaling-up Investment in Energy Efficient Building Retrofits which was developed based on the Project outcomes and approved and initiated at EoP

Based on the review of all available information, the overall results (considering results of all 4 components) were rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

Relevance(*)

The relevance of the project remained very high based on the importance of the EE topic for the Armenian government and since it addressed a number of critical barriers that impede the realization of energy efficiency improvements in the building sector:

- *Outdated building standards*: Building codes did not explicitly address energy performance and integrated building design approach, and codes did not encourage the efficient use of energy in the buildings that are currently built. *Component 1* supported the revision/development and implementation of new mandatory national EE building codes.
- *Low enforcement capacity:* at project start, energy audits were not conducted to determine the energy performance of buildings and their compliance with building codes. *Component 1* supported the development of an energy passport program and the use of audits to determine the actual energy performance of buildings.
- *Immature market for EE products and services:* Outdated technologies and inefficient materials in use by a large number of construction and maintenance companies. The new building codes and building passports developed in *Components 1 and 2* supported the building industry to use more efficient materials.
- *Low capacities of building sector players*: Lack of skills among building design and construction professionals that are necessary to integrate energy efficient

technologies and design techniques into their work. *The Project p*rovides training for architects and engineers including hands-on training in IBDA.

At the Project outset, national practitioners and consumers understood very little about energy efficiency. Appliances and equipment were coming on the market, but the concept of energy efficient buildings was very new. During the Soviet era, energy was very inexpensive. Even now, energy prices have increased but not to the level which covers production and distribution costs and certainly not to levels compatible with the international market. Conservation and energy efficiency remains a relatively new concept in Armenia but the Project has created substantial and sustainable impact and change in the way government, building professionals and consumers think and act.

Based on the review of all available information, Relevance was rated relevant.

R	NR	N/A
X		

Effectiveness (*)

Energy efficient rehabilitation of the existing building stock in Armenia is still practically non-existent due to scarce financing and low capacity of building owners and utilities to accept and repay loans. In this respect,development of an energy efficiency code for buildings and development of the local capacity in Integrated Building Design Approach are effective strategies applicable to Armenia. Such a strategy may have a limited impact in the short-term (during project implementation) due to its delays in adoption. However, its long term potential impact in terms of CO2 savings is substantial.

Due to changes to political alignments beyond the scope of the project (the shift from the EU towards the Eurasian Economic Union in 2014/15), the development and implementation of a new mandatory energy efficient building code was substantially delayed. As a result, energy savings and GHG reductions during the project period (39kTCO2 direct ER resulting from pilot projects and public sector buildings realized since end of 2014) are somewhat below the 60 kT target defined in the ProDoc but sustainable post-project direct impact calculated at 296kTCO2 ER has been secured through this legislation and follow-up projects building on the success of the pilot projects. Accounting the total direct and post-project direct ER (335kT) against the project GEF contribution of US$1.045 million, the effectiveness of the project is 320kTCO2 ER per US$million GEF funding which is very impressive when benchmarked against similar GEF projects in other countries.

Based on the review of all available information, the effectiveness was rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

Efficiency (*)

The project complies with UNDP-GEF incremental cost criteria. Key Project components (changes to legislation, demo projects, training) would not have been implemented (or implemented much later) without GEF funding.

GEF incremental costs were required to implement the project components, which, in turn, have created the enabling environment (legislation and capacity) for large-scale and sustainable impact. As a result of project activities, continued investment in EE

technologies and practices in the Armenian building sector (public and private buildings) is expected.

Demonstration projects have provided the verifiable proof of the effectiveness of EE measures. The GEF contributions towards the construction and renovation of pilot projects cover EE measures and monitoring equipment, which would not have been implemented without GEF funding. (incremental costs associated with thermal insulation, better quality windows, entrance vestibules, new efficient lighting, etc) but also for expert consultation

The demonstration projects have provided verifiable proof of the energy savings provided by these measures and the potential for replication substantially improved by leveraged financing and supporting policy. The project has developed the US$120 mln. GCF/EIB project which will supports continued impact based on successful rehabilitations realized under the project. It is major success of the project. Especially in the existing residential building stock, tenant-owners do not have the financial and political support necessary to realize EE renovation. The GCF/EIB project addresses this and will support large-scale EE renovation in this sector. For new buildings, the project has supported considerable policy development including a new mandatory EE building code.

Based on the review of all available information, the efficiency was rated highly satisfactory.

HS	S	MS	MU	U	HU	N/A
X						

Country ownership

The improved framework conditions being continuously developed leads the Armenian building sector into a transformation process that has already started and will be taking place over next years considering:

- EE is a now clearly high governmental priority and is backed by legislative framework in place including targets specified in Armenia's National Energy Efficiency Action Plan (from 2010)
- Market actors are increasingly showing interest in EE; since building materials certification including testing and capacity building of accredited laboratories is being supported through the Project, and building professionals are trained on IBDA concept. Both activities have improved the awareness and know-how of project developers, architects and engineers as well as public administration/decision-makers in achieving higher quality construction (new as well as rehabilitation of buildings).
- The desire to implement legislation and mechanisms which reduce the energy consumption in buildings clearly originates on the Government side.

Mainstreaming

Amendments to the RA Law 'on Energy Efficiency and Renewable Energy' passed in the final months of the project include the mandatory application of new EE building standards developed under the project to all new building/renovations creating the legal basis for substantial and sustainable direct post-project ER.

In 2015 and the first half of 2016, more than 29 thousand m2 new building and renovation conforming to the new EE requirements set out in Government Decision #1504-N 'on implementation of energy saving and energy efficiency improvement measures in facilities being constructed (reconstructed, renovated) under the state funding' was commissioned under state investment programs.

Further, the Asian Development Bank has provided a loan to the Government of Armenia to rehabilitate or replace 1400 schools throughout the country. 46 buildings are scheduled to be renovated or replaced by 2020 and a further 337 by 2030. The project team has not only reminded the government that these buildings will be subject to the amended Law 'on Energy Efficiency and Renewable Energy' and Government Decision #1504-N but have also prepared designs and calculations which convincingly demonstrate the financial sense of incorporating EE in these buildings.

A dynamic in the Armenian building sector and among consumers has been clearly established. Representatives from the building industry have remarked on the market growth of energy efficiency products (insulation)

Sustainability: financial resources (*), socio-economic (*), institutional framework and governance (*), environmental (*), and overall likelihood (*)

The project has been designed to deliver sustainable impact since the energy efficiency legislation is to be applied and further improved in regard to Building Energy Performance regulations and minimum energy performance standards, and capacity of enforcement and integrating building design principles to be enhanced.

- The following project achievements have helped create a sustainable impact of the Project:
    - Successful co-operation with building developers, construction companies, designer initiated
    - Demonstration projects created public interest and supported residents to get involved in energy efficiency and experience the benefits through improved quality of living.
    - Strong public awareness measures and manifold PR activities were initiated to promote project results to wide audience (e.g. end consumers as well as professionals)
- New technologies (renewables, energy efficiency) have been introduced but need more time to get proper experience and reliability (quality of building materials and equipment)

Not initially a part of the project design, in its final year the Project was able to leverage US$120 million for the post-project EE rehabilitation of residential and public buildings based on success of Avan demo project through the GCF/EIB project De-Risking and Scaling-up Investment in Energy Efficient Building Retrofits" in Armenia which was approved at EoP.. The Sustainability of **Financial Resources** is rated Likely

L	ML	MU	U	N/A
X				

Early in the project, a social survey was conducted by local NGO on awareness of households on issues of energy efficiency, heat supply options, conditions and thermal-technical deficiencies of building envelops, and data on energy consumption in the newly settled buildings in the pilot area.

The survey revealed what the real situation is in the newly built apartments:
• About 40% of apartments express problems with moisture due to the poor insulation of building envelope
• About 30% of households are not satisfied with the quality of windows
• Average internal temperature during the heating season was assessed 15-16 degrees
The mentality of the population has been influence by the project. The people are more interested in EE.

The **Socio-economic** Sustainability is rated likely

L	ML	MU	U	N/A
X				

The most significant change to which the UNDP-GEF project has its direct contribution, is clear intention of Armenian authorities to strengthen energy performance component of construction. It is visible through incorporation of energy efficiency compelling provisions into legal acts, regulative documents, strategic papers etc. as well as readiness to perform monitoring activities to develop the emerging practice.

Institutional Framework and Governance Sustainability is rated likely

L	ML	MU	U	N/A
X				

Improving building codes is an excellent means to affect the large volume of buildings necessary to achieve substantial and sustainable Emission Reductions. The project has developed and implemented a new EE building code with supporting documents..

Environmental Sustainability is rated moderately likely

L	ML	MU	U	N/A
X				

Looking into the specific components where the project has fostered sustainability:

- Component 1 – design and enforcement of new EE building codes and standards, is one of the most relevant project outcome in terms of expected impact and sustainability. Institutional capacity building and enforcement needs to be developed and put in place and incentives provided to the building sector to provide a basis for long-term implementation of EE measures. This needs upfront political commitments and institutional support, which is to be maintained over the next years. Sustainability of Outcome 1 is rated ***Likely***.
- Component 2 is focused on the QC, testing and certification of EE materials and equipment. Laboratories and procedures for buildings materials testing and certification have been established and the market has been growing... Sustainability of Outcome 2 is rated ***Likely***.
- Component 3, the project has supported outreach, training and education, outlasting the Project duration. Institutional backing and some long-term strategies for awareness raising have been established among project stakeholders and target groups and improved capacities to promote IBDA into the professional sector (architects and engineers, university curricula, training programmes, dissemination). However, as legislation will be further upgraded, the institutional setting and professionals need continuous support to meet these conditions without major problems.

From the perspective of public outreach and dissemination, the Project has shown strong performance.
Sustainability of outcome 3 is therefore rated *Likely*.

- Component 4, demonstrating integrated building design,. The project has realized the development, enactment and implementation of revised building legislation which supports energy saving and GHG reductions in the Armenian building sector. The change initiated by this legislation is evident in the demonstration projects and the EE technology market. In the future, local practitioners shall be required to comply with new codes and will be able to refer to the demonstration projects. National experts now have first hand experience and new university programs on building energy efficiency have reference cases. Sustainability of outcome 4 is therefore rated *Likely*.

The **overall sustainability** of the project is rated likely

L	ML	MU	U	N/A
X				

Impact

The IEEB Project has delivered numberour achievements which combined have excellentprospects to sustainably improve energy efficiency and reduce GHG emissions in the Armenian building sector.
Key project results which have established high level sustainable impact include,

- New EE buildingcodes and supporting legislation setting mandatory energy performance requirements for new and renovated buildings in the complete buildings sector,
- Numerous high-profile EE pilot buildings and renovations in residential and public sectors which continue to demonstrate cost-effectiveness and comfort. Demonstration projects have shown that improved design can realize savings of at least 35% and up to 60% compared to the baseline
- considerable leveraged financing for future EE interventions in the Armenian building sector including the US$120million GCF/EIB Project supporting EE rehabilitation and the ADB loan to renew and build 1400 schools to high seismic and EE standards throughout the country
- National building energy performance auditing and certification methodologies
- Testing and certification for EE construction materials has been established. The market for locally produced insulation materials has risen ,
- training curricula and textbooks in integrated building design for building sector professions

Conclusions, Recommendations & Lessons Learned

The project progress overall can be considered as highly satisfactory and in line with the project document for all 4 components. Under Component 1 a new EE building code has been developed and enacted which sets mandatory requirements for building energy efficiency in the whole building sector. The project has been particularly successful in the demonstration and outreach components. Over 8 demonstration sites have delivered proof of the cost-effectiveness and comfort of EE building. They have proven that improved design can realize energy and CO2 savings of at least 35% and up to 60% compared to conventional construction. The project has been able to position itself as a

centre of competency for energy efficiency within the Government in Armenia. The project has cooperated well with private sector: construction materials testing laboratories; insulation materials producers; real estate brokers, residential building developers, design institutions. Two insulation materials testing laboratories, equipped and operational by the project midterm, continue to contribute to the sector development. Market share of tested and certified insulation materials have increased. In addition, the project went beyond ist initial scope by supporting EE retrofit of residential building and has leveraged substantial financing from GCF/EIB for the continuation of policy reform and market transformation in this sector

Actions to follow up or reinforce initial benefits from the project

1. Based on the success of project demonstration buildings (especially the rehabilitation of the existing residential building in AVAN district of Yerevan, the project has developed and implemented a comprehensive 'exit strategy' in the form of the US$ 120 million GCF/EIB Project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits.' The GDF and EIB support the 20-year project which supports EE rehabilitation of public and residential buildings in the country. This follow-up project builds upon and strengthens the long-term impact of the project. It is recommended that the project team coordinate the 'hand-over' with stakeholders in order to identify and, as necessary, train responsible parties to maintain monitoring, data collection, dissemination (web-site) and enforcement mechanisms developed under the project after closure.
2. An accountable methodology (Calculating Greenhouse Gas Benefits of the Global Environment Facility Energy Efficiency Projects - Version 1.0, March 2013) has been applied to calculate the energy and GHG savings from the project period, based on the results of the pilot projects and considering new buildings constructed according to the new building code. The energy and GHG monitoring should be continued after project termination through a suitable public entity with staff trained by project GHG experts.
3. The minimum building energy performance requirements set in the new mandatory building code need to be tightened regularly (at least every 5 years). The new regulations are a strong basis, but compared with international practice (even with some other countries in the region) there is still substantial potential to further reduce energy consumption from buildings with proven cost-efficient measures.
4. The regulations developed under the project are still largely based on prescriptive measures (minimum u-values of external walls, windows, floor and roof.) The transition to performance based codes (based on maximum kWh/m^2yr including heating and cooling loads) needs further capacity support and development.
5. Local building sector experts need further contact with international expertise and best practice tools. If the local experts and practitioners are given adequate access to state-of-the-art procedures, methodologies and tools, they will apply

them. A spreadsheet application for building energy performance calculation (kWh/m2.a) and certification which incorporates national climate data, calculation methodologies and code requirements has been developed and made widely available as a tool for students, building professionals and designers. The tool is available free on the project website: http://www.nature-ic.am/improving-ee-in-buildings-reports-and-publications

6. The pilot projects have demonstrated the interest of local developers and real estate companies in realizing energy efficient buildings. These professionals should be further supported through outreach, information and administrative incentives.

Proposals for future directions underlining main objectives

7. Government incentives and financing mechanisms should be developed and implemented to help support public and private sector investments in EE measures and practices for buildings. Cost savings resulting from energy conservation in public facilities often lead to budget reductions in subsequent years. National spending is reduced, but the facility itself rarely benefits directly from the cost savings. An incentive programme should be developed to further motivate public facilities to save energy (through energy management or further investments in EE/RE) to help ensure sustainable impact.
8. Energy tariffs currently do not support the large-scale uptake of EE and RE measures in the private sector. Low energy costs mean long payback periods for even the most cost-efficient EE measures. Tariff structures (in combination with possible financial incentive programmes) should be evaluated based on the potential of increasing private sector investment in EE / RE technologies.

Best and worst practices in addressing issues relating to relevance, performance and success

9. The new EE building code was endorsed in the final week of the Project Improving building codes is an excellent means to affect the large volume of buildings necessary to achieve substantial impact. However, according to GEF calculation methodologies, accounting the immense and largely post-project impact of such projects remains highly dependent on the timely implementation of legislation and national building programmes. Delays in the endorsement of legislation or implementation of government programmes are a common risk in these types of projects.

10. Energy efficient rehabilitation of the existing building stock in Armenia is still practically non-existent due to scarce financing and low capacity of building owners and utilities to accept and repay loans. In this respect the project's efforts to actually address this issue by demonstrating solutions and leveraging financing for this sector should be commended. The leveraging of US$120 million investment in the form of the 20-year Green Climate Fund/European Investment Bank Project 'De-risking and Scaling Up Investment in Energy Efficient Building Retrofits' which addresses EE in existing public and residential buildings can certainly reinforce initial benefits from the project. Further, the focus of the project on development of an energy efficiency code for buildings and development of

the local capacity in Integrated Building Design Approach is perhaps one of the most effective strategies applicable to Armenia. Such a strategy may have a limited impact in the short-term (during project implementation) due to its relatively long adoption time. However, its long term potential impact in terms of CO2 savings is substantial.

11. Pilot projects designed, realized and monitored under the project have provided verifiable cost savings of EE measures for Armenian construction market. The use of standard building layouts developed prior to project implementation meant many key opportunities to achieve and showcase the benefits of some proven no-cost, low-cost measures (compact building form, orientation to benefit from solar gains, etc) were not identified and implemented in the demonstration projects. This lesson is not particular to this project but is a general problem applicable to many building sector EE projects which set out to demonstrate the Integrated Building Design Approach but end up applying better insulation to standardized designs. Although the resulting buildings are more EE, they do not take full advantage of the potential energy and lifecycle cost efficiency of IBDA.
12. An accountable national building material, component and equipment testing and certification scheme supports the quality and consumer confidence in EE and RE technologies. Material and equipment certification enables planners, investors and consumers to make informed decisions regarding up-front costs (based on quality of the product) and long-term saving potential. Material certification also supports quality control and verification of code compliance at the building site.
13. Demonstration buildings need to strike a careful balance between showcasing new technologies and using traditional construction methods and practices. For the most part building materials and practices used in the public demonstration buildings were local – this ensured a good cost balance and a high replication potential.

Annexes

- Annex A - ToR
- Annex B - Mission Itinerary
- Annex C - List of persons interviewed
- Annex D - Summary of field visits
- Annex E - List of documents reviewed
- Annex F - Evaluation Question Matrix
- Annex G - Questionnaire used and summary of results
- Annex H - Evaluation Consultant Agreement Form
- Annex I – Terminal Evaluation audit trail
- Annex J – Terminal GEF Tracking Tool