ENERGY COOPERATION BETWEEN THE EU, THE LITTORAL STATES OF THE BLACK & CASPIAN SEAS AND THEIR NEIGHBOURING COUNTRIES

PROGRAMME FUNDED BY THE EU

Development of a road-map for introduction of an energy performance certificates system in the building sector of Armenia, including legal framework and distribution of institutional roles CWP.04.AM (AHEF.124.AM)

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Abbreviations

ADENE	Agência para a Energia, Portugal
AST	Armenian (National) Standard
BPIE	Buildings Performance Institute Europe
CEN	European Committee for Standardization
DEAP	Dwelling Energy Assessment Procedure
DHW	Domestic hot water
EE	Energy Efficiency
EN	European Norms (standards developed by CEN)
EPB	Energy Performance in Buildings
EPBD	Energy Performance in Buildings Directive
EPC	Energy Performance Certificates
EU	European Union
GEF	Global Environment Facility
GHG	Green House Gas emission
IEA	International Energy Agency
ITS	INOGATE Technical Secretariat
MoENR	Ministry of Energy and Natural Resources
MS	Member States of the European Union
MUD	Ministry of Urban Development
NEEAP	National Energy Efficiency Action Plan
PC	Partner Country
RA	Republic of Armenia
RACN	Republic of Armenia Construction Norms of the Republic of Armenia
RE	Renewable Energy
RESEnC	Renewable Energy Sources Energy Community
SEAI	Sustainable Energy Agency Ireland
SNiP	Soviet construction norms established by the USSR's GosStroy
TA	Technical Assistance
TR	Technical Regulation
UNDP	United Nations Development Programme

1. PART 1 – EUROPEAN COMMISSION

1.1. Background

Assignment Title:	Development of a road-map for introduction of an energy performance certificates system in the building sector of Armenia, including legal framework and distribution of institutional roles, CWP.04.AM (AHEF.124.AM)
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1.2. Essence of the Activity

The Technical Assistance (TA) assignment on the development of a Road Map for the Introduction of an Energy performance Certification System in Armenia was implemented during the period May 2015 – February 2016. The TA was requested by the Ministry of Urban Development of Armenia (MUD) that is responsible for the development of policy and regulations in the building sector.

About 40% of GHG emissions in Armenia are caused by buildings and this sector has the highest potential for the implementation energy efficiency (EE) measures in the country. Taking into account that an energy performance certification system is one of the most cost-effective instruments to improve EE in buildings in the EU, Armenian decision makers requested ITS to develop a road-map to introduce the EPC system in Armenia based on the best EU practice.

As an additional activity to support the development of EPC in Armenia, and in other PCs, ITS conducted a combined event on Benefits and Requirements of the EU Directive on Energy Performance in Buildings (EPBD) which took place in Copenhagen, Denmark between 14 and 18 December 2015. The event showed the implementation of the EPC in practice, enhanced the capacity and enabled the participants to independently transpose EPBD into the national legislation frameworks.

The ITS fully achieved the overall and specific objectives of the TA assignment (see section 2.2) that were related to the approximation of Armenia with EU legislation and contribution to the improvement of EE in building sector.

1.3. Key Findings

1. As a first step, Armenia adopted a voluntary National Standard on building energy passport and issued energy performance labels for 15 buildings. The lessons learned from issuing certificates can play a central role in designing the certification scheme in Armenia.

2. Lessons learned in EU MS can to a high extend serve as basis and inspiration for the development of similar systems in Armenia, but none of these systems can be directly transferred or copied in Armenia.

3. EU experience shows that it is very important to design the proper implementation of EPC at the early stages as many important decisions need to be taken in the planning phase. Thus the developed Road map will allow Armenian decision makers to design a solid foundation for the development of a transparent and reliable EPC system.

4. Current minimum energy performance requirements approved about 25 years ago are outdated and have a very low level of enforcement.

1.4. Ownership and Benefits of the Activity

The main benefits of the activity for the Beneficiaries are:

1. The Armenian experts and decision makers improved their understanding on elements of the EPBD and next steps required for introducing an energy performance certification system accordance with the EU best practices.

2. The Road Map developed will allow Armenian decision makers to design a solid foundation for the development of transparent and reliable EPC system.

- The Beneficiaries took ownership in the following way:
  1. The Beneficiary and local stakeholders provided ITS with all requested information and necessary support during the preparation and implementation stages.

  2. The preliminary ITS proposals and the Road Map were discussed with experienced experts and decision makers during the second mission in November 2015. The results of the discussions and received comments are reflected in this report

  3. As a result of this TA, Armenia already initiated the transposition of the EPBD into national legislation in a form of technical regulation. The ITS recommendations developed within this assignment will help the MUD to further design a solid foundation for the EPC.

1.5. Recommendations

1. It is recommended for Armenia to implement the certification in steps and to start the implementation of the certification scheme for new buildings only. The certification scheme should be introduced together with the minimum energy performance requirements for new buildings and certification of existing buildings should follow in a 2-year period, when the country has necessary capacity and experience.

2. Armenia should introduce modern minimum energy performance requirements for new buildings that should also be aligned with the National Standard for building passports. The tightening of minimum energy performance requirements should be established from the beginning and industry should take part in this process. It might be also recommended to develop new standards or adopt current standards to different types of buildings.

3. It is recommended to foresee an appropriate period of time between the approval of the EPC legislation and the date of entering into force so all interested parties have enough time to get prepared and comply with the new minimum energy performance requirements.

4. It is crucial to create/appoint the authority responsible for the establishment, management and assuring quality control of the certification scheme. Ideally, it should be an independent National Energy Agency for EE and RES, the creation of which was envisaged in the 1st NEEAP.

5. It is recommended to establish a self-funding EPC system, using the economically calculated fees for issuing certificates and maintaining the system. This should comprise a small fee paid by assessors when issuing and reporting certificates. The assessors should include these costs in the price of their services for the clients. Therefore, only the first step of the creation of the certification scheme should be financed by the government or/and by a donor organisation.

6. The well-designed certification scheme should include a mandatory software (tool) to calculate the energy performance of the building. The calculation software will provide a number of benefits for Armenia, including the transparency of the calculation methodology, and the reduction of costs for calculation and collection/update of important statistic information for decision making process.

7. Tailored capacity-building trainings for potential assessors should be conducted after the development of the above-mentioned software (tool) and the curriculum for the potential assessors. Ideally, an independent National Energy Agency should lead this process and conduct regular examinations to make sure the assessors demonstrate their competence to provide their services to a consistently high standard.

1.6. Challenges Faced

The ITS experts did not face any challenges during the preparation and the implementation of the TA assignment, except the timeframe. The implementation of the assignment coincided with the start of a new EU-funded project “Concerted Action EPBD IV” where the principal expert for this assignment Mr Jens Laustsen has been also involved as a coordinator.

Table 1. Impact Matrix

Impact Area	Developments	2012 (%)*	Feb 2016 (%)*
Policy	*Support of the implementation of EPBD and its elements, like certification scheme, minimum energy performance requirements etc.*	0%	30%
Regulation	*Armenia has already initiated the transposition of the EPBD into a national legislation in a form of technical regulation*	0%	40%
Technology	*Support of the development and utilisation of modern EE technologies, primarily in buildings. Promotion of local business with low impact on the prices of new dwellings*	5%	40%
Environment	*Improvement of EE in buildings significantly reduces CO_2 emissions.*	5%	45%
Economics	*Indicators of decreased energy dependency*	4%	24%
Social	*Better indoor climate and living conditions for citizens.*	5%	25%

* The impact is estimated based on the experts’ opinion under the current circumstances and can be changed over time

Note: It is particular difficult to quantify the impact of capacity building activities. The figures provided in the table should therefore be considered with great caution.

2. PART 2 – BENEFICIARY

2.1. Executive Summary

This report presents the results of the assignment "Development of a road-map for introduction of an energy performance certificates system in the building sector of Armenia, including legal framework and distribution of institutional roles" implemented by the EU funded INOGATE Technical Secretariat (ITS) project. The assignment was requested by the Ministry of Urban Development of Armenia (MUD) and was implemented during the period May 2015 – February 2016.

This assignment aimed to provide a contribution to the improvement of energy efficiency in building sector of Armenia through the development of an energy performance certification system and the further approximation of its national legislative framework with the EU Directive on Energy Performance in Buildings. The specific goals included the development of proposals and recommendations for a road-map on the introduction of an energy performance certificates system that could then be further adopted as a legislation act in Armenia.

During the second mission to Yerevan in November 2015 the ITS experts presented preliminary recommendations to the MUD and received a specific request of not proposing concrete measures, but to identify directions for the development of EPC that should be further decided by the beneficiary. Thus, this report suggests ways to transpose EU best practice on EPC and provides the MUD the opportunity to make the important decisions regarding the details of the Road Map, i.e. type of the building for initial certification scheme, level of minimum energy performance requirements, responsible authority, timeframe, etc. This part of the report consists of seven chapters and annexes.

Chapters 2.1-2.5 are the standard parts of an ITS report that provide information about the objective and the essence of the assistance, as well as the specific conditions and baseline for the evaluation of the results of this assistance in the future.

Chapter 2.6 provides general recommendations for the adaptation of EPC in Armenia based on the analysis of existing local experience and best practices in the European Union that are presented in Annexes 1 and 2 accordingly. Chapter 2.7 outlines the structure of the Road Map and the key directions for the decision making process regarding the introduction of EPC in Armenia. This chapter also provides references to the European CEN standards (Annex 3) relevant to Energy Performance in buildings (EPB) that can be adopted in Armenia.

Whereas Annex 4 of this report provides the general structure of the Road-Map for the implementation of EPC, Chapter 2.7 describes the activities of the first three initial parts of the Road Map that establish the most important foundation for the development of transparent and reliable EPC system in Armenia. Annex 5 of the report also illustrates the example of the Stage 1 of Road-Map for the implementation of EPC in new buildings in Armenia.

Chapter 2.8 offers the key conclusions and recommendations summarising the results of the analysis of the previous chapters. The conclusion highlights that Armenia has already started implementing number of initiatives and it is apparently on the right way towards the implementation of the EPBD into the national legislation framework. AT the same time all current and planning initiatives should comply with ITS recommendations in order to design a solid foundation for the development of transparent and reliable EPC system in the future.

2.2. Introduction

The assignment "Development of a Road Map for the Introduction of an Energy Performance Certification System in Armenia" was implemented during the period May 2015 – February 2016. The overall objectives of this assignment were the approximation of Armenia with EU legislation and contribution to the improvement of energy efficiency of the building sector of Armenia, according to the best EU practices. The Specific Objectives were to:

- Provide the Ministry of Urban Development (MUD) with a consultative assistance to incorporate the requirements of certification of buildings of the EU Directive "On energy performance in buildings" in the national legal framework in Armenia;
- Develop a Roadmap for implementation of energy certification of buildings sector in Armenia;
- Enhance capacity of the Armenian stakeholders on the reforms needed to improve energy efficiency in buildings and to overcome barriers for implementation.

2.3. Rationale

According to the Public Services Regulatory Commission of Republic of Armenia, about 35.6% of electricity and 25.6% of gas was consumed in the residential sector of Armenia in 2014. The sector is expanding, which is bound to increase its energy consumption. Therefore, reduction of energy consumption in the building sector constitutes an important measure needed to reduce the country's dependency on fossil fuels and decrease its greenhouse gas emissions. According to the information provided by the Ministry of Urban Development (MUD), about 40% of GHG emissions in Armenia are caused by buildings.

According to the National Programme on Energy Saving and Renewable Energy, adopted by the Government of the Republic of Armenia on 18.01.2007, the building sector has the largest potential of energy savings and the most cost-effective measures to improve energy efficiency: 40% of the national energy saving potential is in the buildings sector, which is the equivalent of 402,000 toe or 944,000 tCO2e of GHG emission reductions annually.

Energy performance certificate systems is one of the requirements of the EU 2010/31/EU Directive on energy performance of buildings (EPBD) and EU Member States have already established a system of certification. The energy performance certificate includes the energy performance of a building, its energy consumption and suggestions for improvement in order to make it possible for owners or tenants to compare and assess its energy performance. An Energy performance certification system is one of the most cost-effective instruments to improve EE in buildings in the EU. Thus, the successful experience of the EU can be efficiently transferred to other countries, including Armenia.

2.4. The special conditions of buildings and climate in Armenia

Armenia is willing to improve the energy efficiency in buildings in general and to introduce the certification of buildings as an instrument to achieve this objective. This has been strongly documented both in the setup of this project and during the first ITS missions in May and November 2015.

It is further obvious that there is a large potential of energy savings, which can be harvested both in existing and new buildings. This is due to the relatively low efficiency in a large part of the existing

building stock, and a very low level of EE minimum requirements and their enforcement in new buildings. A large part of the existing buildings were built after the Second World War and up to the end of the 20th century and many of these buildings have been part of large development projects whereby little adaptation to the climate conditions of Armenia was taken into account as well as little attention was paid to energy use.Hot summers and very cold winters drive the climate in most parts of the country. The humidity is low and there can be a significant difference between day and night temperatures. This yields special demands for building construction and for energy efficiency measures. Armenia has a mainland climate and some elements are strengthened by the fact that most of the population live in relatively high altitudes. Most of the cities in the country are placed at 1,000 meters or higher. Some settlements are in even higher altitudes.

The largest concern in Armenia is heating and the heating degree-days that vary from relatively moderate (1500 - 2400 degree-days) to very cold climatic conditions with heating degree-days going up to or above 4000 degree-days per year. However, some regions also have significant cooling loads in the summer. For many buildings built in the last half of the twentieth century, there has been little emphasis on these specific climatic conditions and some of the buildings have low energy performances under these conditions, creating overheating in the summer, resulting in the need for cooling, and low room temperatures or high heating loads in the winter.

This creates a double emphasis: on keeping the heat out and protecting the buildings against the sun in the summer, and keeping heating in and using solar gains in the winter. It further creates challenges in the change of temperature between night and day. The differences between day and night time temperatures can, however, also be turned into an asset if cold night air is used to reduce the need for active cooling.

A further complication in Armenia is the current influence of large earthquakes, which recurrently has created large destruction of buildings and a special demand to rebuild very fast. This can influence the level of efficiency as the rehousing of people has been an absolute top priority and has evoked less emphasis on the efficiency and energy quality of the new buildings. Due to the fact that large earthquakes are also likely to occur in the future, there is a need to put a high focus on this and the insurance of building constructions to avoid the collapse of buildings even under strong seismic activity. This can, to some extent, work against efficiency as the structure needs to be enforced and the outer and inner structures need to be connected to strengthen the building.

There is no possibility (not an acceptable option) to compromise the safety of buildings against seismic activity and this needs to have a higher priority compared to energy efficiency. This raises a special challenge for energy efficiency to be adapted to the higher priority of seismic resistance. This creates a very specific set of challenges for Armenia and all initiatives need to be strongly adapted to these circumstances.

Thus, the above finding raises specific questions on how to combine energy efficiency and seismic stability as well as how to adapt solutions for improvements so that this doesn't influence the stability of buildings.

2.5. Baseline assessment

The baseline assessment was established according to the analysis of the current situation in Armenia presented in Annex 1 and the evaluation of the results of the combined event on Benefits and Requirements of the EPBD which took place in Copenhagen, Denmark between 14 and 18 December 2015. The Combined event on EPBD was organised as a follow-up to this assignment in order to show the decision makers the implementation of the EPC in practice and support the development of EPC in Armenia.

Based on the analysis conducted in Annex 1, the absence of legislation on energy performance certification system in the building sector is considered to be the baseline situation. The development and approval of legislation on EPC should therefore be considered as direct tangible result of this assistance. It should also be mentioned that during the implementation of this assignment, Armenia has already initiated the transposition of the EPBD into a national legislation in form of a technical regulation. Taking into account that Armenia has no responsibilities to implement the EPBD into the national legislation framework, some elements of the Directive might be excluded from the document, but it is strongly recommended to use ITS recommendations for the development of a solid foundation for introduction of EPC in Armenia.

The ITS Combined event on EPBD invited two representatives of the beneficiary, the MUD and one representative of the MoENR to Copenhagen, Denmark. In order to evaluate the event's impact on enhancing the skills and knowledge of the participants, ITS developed a tailored test and a Self-Assessment Questionnaires. The results of the tailored test that was carried out before and after the event showed that the Armenian participants benefited from the event and enhanced their knowledge and skills the most in comparison with other delegates from INOGATE PCs (Figure 1)

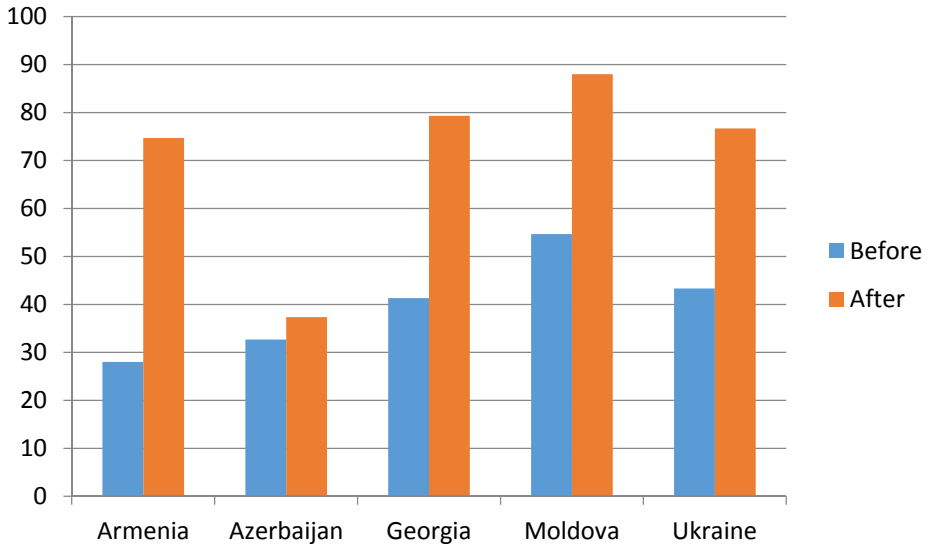

Fig.1 Average results of the 'before' and 'after' tests, per INOGATE Partner Country

Taking into account that questionnaires were confidential, it is impossible to evaluate the self-assessment of Armenian participants' skills regarding the implementation of EPC in Armenia. However, on average, the questionnaires revealed that the participants felt that their capability was 'Satisfactory' and 'Basic' at the beginning of the event but this had increased to 'Good' and 'Full understanding' at the end, thereby demonstrating a clear increase in the participants' self-

assessment of understanding elements of the EPBD, including EPC, in order to be able to transpose it into national legislation.

2.6. Adaptation to Armenia

Lessons learned in EU Member states that are provided in Annex 2 can to a high extent serve as basis and inspiration for the development of similar systems in Armenia, but none of these systems can be directly transferred or copied in Armenia. Lessons learned, systems in EU Member States and common standards (see Annex 3) can therefore be used as part of the development of similar systems in Armenia, but it is important to base this development also on in the national experience and the very specific conditions of the country.

In this chapter we intend to combine systems and experience in Armenia (see Annex 1) with some of the best practices in the European Union (Annex 2) and to develop this into some recommendations for adaptation of an Energy Performance Certification system based on the local context.

Buildings covered by the certification

In the European Union, all buildings for residential and non-residential use are included in the energy performance certification scheme with some exemptions of buildings used for production and buildings with very low energy intensity. All these buildings need certification for construction, sale and rental. For large public buildings, there is a further demand to provide a regular declaration of energy consumption displayed in the building.

This might also be the end goal in Armenia, but given the current situation and also the costs of energy, the building stock in general and the overall level of the industry it seems too ambitious to implement such a comprehensive system in one go.

In Armenia, it seems much more rational to develop such a comprehensive system in multiple steps. It would be logical to start with some buildings and develop systems, capacity and acceptance stepwise. Different types of buildings were discussed during the first mission in Armenia and several building types came up in the different ministries.

Some elements, which could seem interesting at the beginning, could be large public buildings, buildings receiving public support, or new constructions.

Multiple story residential buildings with high-energy demands could also be a very beneficial target building type as these entail large potentials and the energy efficiency improvements could serve multiple purposes in terms of improved life quality and lower costs for people with fewer resources. Such programmes could perhaps be combined with international funding, for instance through regional development funds lifting off the costs for users and increasing benefits.

Certification of new buildings can help with compliance issues with current building regulations and can also help to identify further measures for new buildings, which then on a longer term can be included in building regulation. Furthermore, such a system can help to identify buildings, which perform better than the norm.

It is important to develop such systems at a pace where the industry, capacity and the development can follow in a timely manner. In Armenia, where the experience with such certification is limited and where capacity in energy efficiency in buildings are relatively new, it could be beneficial to start

with a more limited set of buildings and then to develop certification in steps, where this covers more and more types of buildings.

Calculation procedures

Systems for certification including rules for calculation need to be developed; these systems should basically be based on the national rules and guidance, which are also used for new construction and for improvement or renovation works in existing buildings.

The experience from Europe where CEN (European Committee for Standardization) has worked on such standards since 2003 in connection to the adoption of EPBD shows that this is a very complex process. It has especially been very difficult to combine the different standards and to get an overall complex of standards, which give a good picture of energy performance in all types of buildings. Many elements of the European standards can be used as a model or inspiration for this process and in some cases it might be easier and better to adopt one of these standards than to make a new development or adaptation of existing standards. Many European CEN standards (see the full list of standards compiled by the Danish Building Research Institute in Annex 3) include multiple possibilities and maybe some of these can be used also in Armenian context.

As the first step, it might be beneficial to use the current Armenian standards, i.e. 362-2013. Building Energy Profile. Main provision and Typical form. Once both energy auditors and governmental bodies get enough experience, a new more elaborated standard can be introduced into the Armenian legislation framework.

Labelling Certificates

A first version of a certificate has been developed for the demonstration of an energy performance certificate made by UNDP / GEF, this can be adapted to be used more commonly.

European experience shows that such certificates and the design has a large impact on the acceptance and the use of these systems. They need to be recognisable and encourage consumers or building owners to go for the best options and to understand messages on possible saving measures.

It is therefore a good lesson to spend time on testing the certificates, for instance through consumer tests or focus interviews before the system is blocked on design and type of information.

Scales for buildings need to be well adapted to the local context and suit with the current building stock. Scales should give a good spread of the existing buildings and still leave room for improvements. If labelling is intended to stimulate further investments it is important that it is possible to move on the scales if buildings are improved. There should further be room for buildings to become better than the current norm and best practice.

In Armenia, this means that scales should be developed based on information on the building stock and for all types of buildings, which will be included in the scheme.

Experts

Experts responsible for certification need to have sufficient skills and also need to be trained in the process of labelling and calculation. The need for training will depend on the choice of experts to be appointed in the scheme.

In most European certification programmes, the experts used are architects and engineers who require some technical training within construction and renovation. The experts typically have to have practical experience within the field of construction and renovation and perhaps in energy efficiency. This ensures a good basic knowledge and capacity.

Furthermore, there is usually a need for specific training in rules and special elements of the certification procedure and advice on possible energy efficiency improvements. Training can last a few weeks long or take a longer period of time. This will highly depend on the previous experience requested.

There is often a need for recurrent training, for instance annual training or meetings to ensure all experts are up to date. The initial training can take long time when new schemes are introduced and a large group of experts needs to be trained. This needs to be carefully considered when planning.

For Armenia, it is important to use the right institution for approval and training of these experts and to select experts with a significant background. Considerations supporting earthquake stability are needed in Armenia, and this can increase the demands for these experts as proposals must never compromise this safety.

Handbooks and calculation tools

Handbook and calculation tools are central elements in ensuring the right quality of certificate and a similar rating for similar buildings is provided, even if different experts perform them. These can also help to reduce costs for the certification.

Handbooks must be developed based on local examples and calculation tools must follow the chosen standards and must allow for typical Armenian constructions and local options for energy efficiency improvements.

This material can, to some extent, build on international best practice, but it has to be adopted to the national context and presented in Armenian. Many EU Member States have handbooks and all the three examples in Denmark, Ireland and Portugal have very comprehensive handbooks and guidelines, which could serve as model for such a development. For example, Irish handbook and calculation tool named “Dwelling Energy Assessment Procedure (DEAP)” can be downloaded using the link below:

http://www.seai.ie/Your_Building/BER/BER_Assessors/Technical/DEAP/Introduction_to_DEAP_for_Professionals.pdf

Quality control

Experience from EU Member States shows that quality control is a key element of an EPC system. This needs to include independent control of certification and a check of certificates. Often systems are combined with penalties, meaning that experts can lose the right to issue certification. Quality control is often combined with a national database for certificates.

A system of certification needs to be developed in a way that fits with the legal framework in Armenia. Rules for quality control need to be set as a part of the development of the scheme and also the legal framework.

Legal framework

The legal framework for certification will include multiple ministries and agencies. There are many actors, like MUD, MoENR, Ministry of Economy, Energy Institute and inspection authority, involved in certification. These actors should be involved from the early state of the development of systems as this gives the best solution and the largest impact of the system.

The roles of the different actors should be adapted to the existing structure and responsibilities in Armenia.

2.7. Setting up a Roadmap

The Overall Roadmap for the implementation of EPC is provided in Annex 4, whereas this Chapter describes the activities of the first three initial parts that establish the most important foundation for the development of transparent and reliable EPC system in Armenia. During the second mission to Yerevan in November 2015 the ITS experts presented a preliminary recommendations to the MUD and received a specific request of not proposing concrete measures, but to identify directions for the development of EPC that should be further decided by the beneficiary[1]. Another request from the beneficiary was to concentrate on the initial stages of the Roadmap that establish the foundation for the EPC system. Therefore, the recommendations below are developed in a way to provide the beneficiary the prospect to make the important decisions regarding the crucial details during the preparation of following parts of the Road Map:

1. Clarification and Concept;
2. Development of Systems and;
3. Training of experts.

The first part of the roadmap will be the review of existing systems, template and calculations. Many decisions need to be taken at this time in order to develop an efficient system. This includes decisions on the type of buildings, which will be included in the certification requirements and for which these will be mandatory.

Armenia has already some experience with the demonstration of certification and with energy efficiency in new buildings. Many questions need to be decided upon early in the process and there is a need for substantial planning of the new rules for energy performance certification. This will have a major impact on the planning as well as the timeframe for the development of mandatory certification. Implementation of larger certification systems covering most buildings will take several years. Some types of buildings that could be the start of performance certification in Armenia are larger public buildings, subsidized building or new buildings. Some elements exist in Armenia and there are best practice international experiences that need to be adapted to Armenian circumstances.

Decisions taken in this part will have a very significant impact on the work in the following phases of the implementation. Below are some specific recommendations for the first parts of the roadmap:

[1] The presentations given by the ITS experts during the second mission to Armenia can be downloaded from the http://www.inogate.org/activities/540?lang=en&order=date_issue_desc&section=documents

Part 1: Clarification and Concept

	Clarification / Concept
Overall System	It is critical to develop clear objectives for the new certification system. These have a critical impact on the system to be developed. As part of this many questions need to be answered: **Which buildings should be included?** • For a country like Armenia where there is a need to develop capacity it is recommended to start stepwise. • In the first step, focus should be on new buildings – to support compliance with building codes (building code should also establish modern energy performance requirements for new buildings). • In the second step, certification should include types of existing buildings. **What is the main purpose of the Certification?** • For new buildings it could be to set more focus on energy efficiency and on compliance with the building codes. • It could also include encouragement to go beyond minimum requirements. • In existing buildings it should encourage to achieve energy savings and to document results of work already undertaken. **What are the main qualifications of experts?** • Which experts should be qualified to do the certification? • What further qualifications are needed?
Certificate	**What can be reused from existing experiences?** • What worked well? • What is easy to understand and what needs improvement/further explanations? **What are main feature that need to be illustrated/documented?** • Energy performance or energy consumption? • Environmental issues such as CO2? • Connection to other issues, i.e. scale from A++ to E should be connected with the modern minimum energy performance requirements?
Calculation	**What type of certification is needed?** • For new buildings certification needs to be based on asset rating (calculated consumption) • For large existing buildings operational rating (metered consumption) could be favourable **What existing standards can support the rating?** **What new elements need to be developed?** **Are there international standards, which can be used?** • EU developed a full set of standards through CEN (see Annex 3)
Frame Work	A strong system for EPC needs the support of a national institution, such as independent National Energy Agency for EE and RES, the creation of which was envisaged in the 1st NEEAP. • This institution needs to set the basic rule and to control the key actors of the system. • This institution needs to set and control the independency of the EPC. **What other ministries and organisations have direct interests in the certification of buildings?** **What are the key roles of the other ministries and organisations?**

As an example, Annex 5 illustrates the example of the Stage 1 of the Road-Map for the implementation of EPC in new buildings in Armenia.

Part 2: Development of Systems

	Development of systems
Overall System	**What are the demands for the experts to perform certification?** • Need for basis training • Need for experience • Need for additional training **Document the certification process** • Write the rules very clear / certifiers handbook • Document correct procedures • Insert means of validation / hidden parts **Set up system of control** • Methodology for checks • Include onsite inspection / new certificate on same building **Set up system for reporting** • Include results in national database • Automatic screening is cheap and efficient
Certificate	**Set up process to develop the official certificate?** • Test certificate on typical users, / building owners **Can the same certificate be used for all buildings?** • There is an obvious difference between existing and new buildings • New buildings might be calculated (asset rating) • Existing buildings also need advice on improvements
Calculation	**Develop clear methodology for certification** • For calculated consumption (asset rating) in new buildings • For metered consumption (operational rating) in existing buildings • How is potential savings estimated **Develop computer tool (software) for certification** • Simplified input and help improves quality • Can this be done by market or is it a public financed tool? • How to ensure accuracy of the tool / testing **Develop training in calculation** • Use of tool • Calculation of consumption, labels and savings
Frame Work	**Who should train the experts / certifiers?** • Which institution can secure the right level and impartiality? • Do they currently have all the facilities and expertise? **Who should do the testing of qualification?** • Which institutions can ensure impartiality? **Set up system for penalties** • Fines? Redo certification? • Possibility to lose approval by fraud and repeating faults • Who can give the penalties? **Involve all relevant ministries and key stakeholders** • Set up committee or advisory group early in process • Inform open about development and systems

Part 3: Training of experts

The training of experts and testing of experts takes a long time. Even if each individual expert might have relative short training period, the process of passing multiple hundreds of certifiers can still be a significant bottleneck for the system. All the important rules for certification and for calculation need to be developed before the training can be done. Tools need to be developed for the certifiers including the computer-based tool for calculations, reporting and issuing of the certificates.

Many European systems have experienced problems because they started before the sufficient amount of experts has been trained or right tools were developed. This process either request that the sufficient time for this process is allocated or that the start is stepwise and take into account the developing number of experts.

2.8. Conclusion and recommendations

Armenia is apparently on the right way towards the implementation of the EPBD into the national legislation framework. The adoption of the 2nd NEEAP with clear supporting measures on the improvement of EE in buildings will facilitate the approval of the energy performance certifications scheme. The Ministry of Energy has already initiated the process of the transposition of the EPBD into the national legislation framework in a form of technical regulation (TR). At the same time both the 2nd NEEAP and the TR on the energy performance in buildings should include the following key provisions:

1. It is recommended to do the implementation of certification stepwise and to start the implementation of the certification scheme for new buildings only. The certification scheme should be introduced together with the minimum energy performance requirements for new buildings. Thus, the properly issued certificate will confirm the compliance of the building with the set minimum energy performance requirements or document that the performance goes beyond the minimum requirements

It is also recommended that the certification of existing buildings should be introduced in Armenia minimum two years after the introduction of certification schemes for new buildings. This will allow to gain experience and to have time for additional development of material and training of experts. According to the EPBD, the energy performance certificate shall be shown to the prospective new tenant or buyer when the building is sold or rented out. Therefore, by the time of entering into force the certification schemes for existing buildings, all beneficiaries in the country will get the necessary experience and the sufficient number of assessors to accommodate the increased demand for certificates. EU experience shows that some of the new MS have been able to establish comprehending systems for new and existing buildings in around 5 years, from real start to full implementation of a system.

2. The current requirement “Building Thermophysics of Fencing Constructions” RACN II-7.02.95 approved about 25 years ago is outdated and has a very low level of enforcement. Thus, it should be substituted by the modern minimum energy performance requirements for new buildings. The requirements should be aligned with the National Standard on Building Energy Profile (AST 363-2013) and Energy Auditing Methodology (AST 371-2016). For example, all new buildings should comply with the requirements for the following energy classes:

- ‘C+’ from 01.01.2017

- 'B' from 01.01.2019

- 'B+' from 01.01.2021, etc.

It will be also required to develop new standards or adopt current standards to different types of buildings. It is also recommended to start with mandatory certification of a more limited set of buildings and then to develop these demands to further types of buildings successively.

It should be also mentioned that the Ministry should identify the appropriate timeframe and the level of minimum energy performance for each type of the building. The representatives of the construction industry should take an active part in this discussion as they will be the implementing party and should agree with the Ministry's proposals before the approval of the minimum energy performance requirements in Armenia. According to the experts' opinion, the timeframe for the implementation of the roadmap will depend on many factors. In order to not delay its implementation, some critical activities indicated in Annex 5 as an example, should be initiated in the short term. Among these tasks, the introduction and determination of compliance with the modern minimum energy performance requirements is the first and critical task for the whole roadmap.

The first certification of new building should support these new codes and the general enforcement, but they can also allow and document building that goes beyond the minimum level and for instance built according to coming legislation.

3. There should be an appropriate period of time between the approval of the certification scheme (meeting the minimum energy performance requirements) and the date of entering into force. The recommended time lag should be one to two years and should be defined by the Ministry in order to have the sufficient period of time for:

- Construction companies to get prepared and comply with the new minimum energy performance requirements;

- MUD or other responsible authority to establish the transparent scheme for the accreditation of assessors (auditors) and issuing the certificates;

- MUD or other responsible authority to enhance the capacity of the sufficient number of assessors for issuing certificates.

4. It is crucial to create/appoint the authority responsible for the establishment, management and quality control assurance of the certification scheme. This is needed to ensure the transparency, liability and impartiality of this authority. Ideally, it should be an independent National Energy Agency for EE and RES, the creation of which was envisaged in the 1st NEEAP.

The institutional structure is a key element for the creation of the successful certification scheme and it is very important to design the institutional structure at the very early stage. As a temporarily measure, a new department on the certification scheme can be established within the MUD. However, it would be rather difficult to ensure the self-financing of the certification scheme under the Ministry's department (please see the recommendation below).

5. The fees and charges for accreditation of assessors, annual fees and publications of the certificates should be calculated in a way to enable self-funding of the certification scheme, including the following:

- maintaining the of the national registers of assessors;

- administering assessor examinations process;

- maintaining/ improving the methodologies and calculation software;

- quality assurance and auditing of certificates issued by assessors;

- administering web-site and helpdesk for assessors and general public;

- promoting awareness of certification scheme;

- provide advice, information and support to the relevant governmental authorities.

Thus, only the first step of the creation of the certification scheme should be financed by the government or/and by donor organisation. Once established, the system should finance itself from the set fees and charges. While calculating the fees, the responsible authority should also take into account the affordability of the population of Armenia.

6. As mentioned above, the well-designed certification scheme should include software to calculate energy performance of the building. The calculation software provides the following benefits for the certification scheme:

- provides a platform for uniform automatic data processing;

- ensures the transparency of the calculation methodology;

- reduces risks for assessors to make mistakes during the calculation;

- reduces costs for calculating the energy performance and the quality assurance check of the issued certificates;

- ensures simple and secure reporting on certification including the most important information on buildings, systems and results;

- provides the basis for the control of the certification process in the individual building;

- stores/updates statistic information in a central database regarding the energy efficiency in buildings and provides input to the national statistical service and decision making process.

7. Tailored capacity building events for potential assessors should be conducted after the development of the above tool and the curriculum for the potential assessors. Ideally, an independent National Energy Agency should lead this process and conduct regular training and examinations (every two years) to make sure the assessors keep updated on new developments and demonstrate their competence to provide their services to a consistently high standard.

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Annex 1: Overview of the current situation in Armenia

Armenia has already started to implement several initiatives and is preparing a system for the certification of buildings. These initiatives include a range of measures targeting different elements, and an energy certification scheme can support the development of an overall system development. They can together support the development and implementation of a new system to support energy efficiency without compromising seismic stability.

Demonstration:

The demonstration of certification of buildings has been supported by the "Improving Energy Efficiency in Buildings" UNDP-GEF/00059937 project. This project systematically collected some data and worked with the development of a certificate and also the design of a certificate, which can serve as a basis for certification of other buildings or can be adapted to a national system.

The data for the building sector was collected with the GEF UNDP office in Yerevan, in connection with the upgrade of buildings and the whole system approach. The developed template includes many elements from existing systems in the EU and was primarily based on the European appliance label and Russian scaling system with a scale from A++ to E. The standard AST 362-2013 "Energy efficiency. Building energy passport. Main provisions. Typical forms" developed by UNDP-GEF expert team was enacted as a voluntary National Standard on January 1, 2014.

The standard is one of the main normative documents setting rules for buildings' energy efficiency classification. It contributes to introduction and strengthening of energy passport and energy efficiency label application of residential and public buildings aiming at improved energy performance in buildings. Based on the adopted standard, the UNDP-GEF implemented energy efficiency measures and issued energy passports for 15 residential buildings. Taking into account that the majority of urban housing stock in Armenia was built during the Soviet period with standard designs, the implemented EE measures and issued certificates for these buildings served as demo projects to be further implemented by the owners of other buildings of the same type.

Lessons learned from the UNDP project can play a central role in the development of the Armenian Energy Performance Certification system, especially if this is combined with lessons learned from international best practice in the most advanced member states in the European Union. As well certificates, calculation procedures and Armenian experience from this demonstration project should serve as central elements in the development of a certification system.

Calculation procedures:

Many of the standards in Armenia are based on common standards in the region and in some cases these are based on Russian standards. Some standards are, however, set and adopted to national conditions and committees.

The most important norms are Construction norms of the Republic of Armenia (RACN) and Construction norms established by the USSR's GosStroy (SniP). Among the norms which will be mostly important for the Energy Performance Certification of buildings are:

- RACN II-7.01-2011 Construction climatology;
- CNM II-7.101-98 Construction of settlements, buildings and structures under the climatic conditions of the RA;

- RACN II-7.02-95 Building thermo physics of fencing constructions;
- BCM/CNM II-7.102-98 Building thermo physics of fencing constructions (Manual on RACN II-70.2-95 norms/codes);
- RACN II-8.03-96 (MCH 2.04-05-95) Artificial and natural lighting;
- RACN IV-12.02.01-04 Heating, ventilation and air-conditioning
- SNiP 2.03.13-88 Floors;
- SNiP 2.08.01-89 Residential buildings;
- SNiP 2.08.02-89 Public buildings and structures;
- SNiP 2.09.04-87 Administrative and residential buildings; and
- SNiP 3.04.01-87 Insulation and decorative coatings.

A standard for energy performance certification of buildings must inevitably combine rules from many of these standards, as it has been the case for the UNDP demonstration project on EPC and which it is the case in the European CEN work. Some elements of energy certification might not be covered by the current norms as there might be challenges in combining these.

Further development of a robust structure could be developed by combining the current Armenian standards and SNiP's with standards developed by CEN and national standards in Member States in connection to the implementation of the EPBD legislation in European Union, supporting Armenia's obligation to implement such systems.

Existing legal framework for energy efficiency

Armenia has different elements in place for a legal framework. They should provide a basis for the implementation of an energy performance certification scheme for buildings. It is important that a new energy performance certification scheme for building is set up to support the existing initiatives listed below. Some of these initiatives can also serve as input for the development of the legal framework and systems for the energy performance certification.

Energy law of the republic of Armenia:

The energy sector in Armenia is regulated by the Energy Law of the Republic of Armenia that was adopted in 2001. The law envisages key roles and responsibilities of different stakeholders on the energy market and sets four pillars of Armenian energy sector, one of which is the utilization of renewable energy and energy efficiency. Other pillars are Nuclear energy, diversification of energy resources and regional integration and cooperation.

Thus, a new energy performance certification system should contribute to the improvement of the EE in the country rather than create new challenges for the economy. The new EPC system should contribute to both: the improvement of energy efficiency and the integration of renewable energy sources in new and existing buildings.

The Law of the Republic of Armenia on Energy Efficiency & Renewable Energy

The Law on EE and RES, adopted in 2004, sets up different principles for energy efficiency and usage of renewable energy sources. Energy efficiency and renewable energy should support economic growth, increase energy independency, increase energy security, support development of new markets and also improve the environment and health issues.

As for energy certification the most important elements of this law concerns the high priority for energy efficient end use and different support for the introduction of renewable energy in the energy mix in Armenia. A new energy performance certification scheme should directly support the goals of this legislation.

National Program on Energy Saving and Renewable Energy

The National Programme on Energy Saving and Renewable Energy of Armenia was adopted by the Protocol Decision № 2 of the Government Session of the RA dated 18.01.2007. The Program foresees specific targets for the improvement of EE in buildings with a particular focus on thermal insulation only.

First National Energy Efficiency Action Plan

The first NEEAP was approved by Government Resolution № 43 dated 4.11.2010 based on principles similar to the demands in the European Directive on Energy Efficiency (Directive 2002/91/EC). This plan outlines a list of actions to improve energy efficiency in all end use sectors for the period of 2011 to 2020. Both residential buildings and the service sector (tertiary sector buildings) are central parts of this action plan.

The action plan includes, among other elements, the provisions for development and implementation of state of the art policies on enhancing energy efficiency, support for finance initiatives and the setup of a National Energy Agency for EE and RES. As for building sector, the NEEAP foresees the following activities:

- Development of the National building code considering energy performance of buildings;
- Development of standard and calculation methodology to access energy performance in the buildings;
- Conducting capacity building activities for implementing and enforcing new standards;
- Establishing quality assurance/control standards supporting the certification of energy performance;
- Information campaigns.

Many of these elements can support or be supported by energy performance certification of buildings and it is important that a system set up will ensure synergies with other initiatives in this package of measures and that it supports the development of capacity as one of the priorities of the NEEAP.

Second National Energy Efficiency Action Plan

Even though the first NEEAP was developed for a 10-year period (2010-2020), the R2E2 Fund with support of donor organisations started the development of the second NEEAP in 2015. The 2nd NEEAP aims at the development of more coherent targets and policies based on the collected statistical data and gained experience of the implementation of the 1st NEEAP during 2010-2015, including in the EE measures in buildings. According to the information provided by the Ministry of Energy, the 2nd NEEAP will also foresee the development of the certification scheme for buildings and minimum energy performance requirements.

Amendment to the Law on Energy Efficiency and Renewable Energy

A law with amendments and additions to the Law on Energy Efficiency and Renewable Energy is currently in the Parliament. This law will, among other issues, increase the authority to set up rules for certification and other energy efficiency measures for buildings. It will also enhance demands and regulation for renewable energy.

This new regulation or revised Law on Energy Efficiency and Renewable Energy will form a central part of the basis for the development of rules for energy performance certification of buildings. It is assumed that this law will be adapted in 2016 and that it can serve as part of the regulation supporting energy certification of buildings.

Draft Technical Regulation on Energy Performance in buildings

According to the information provided by the Ministry of Energy and Natural Resources (MoENR) during the second mission, the MoENR has already initiated the process of the transposition of the EPBD into the national legislation framework in a form of technical regulation (TR). The representatives of the MoENR also confirmed that the implementation of EPBD complies with the Armenian strategic goals and does not contradict with the objectives of the Eurasian Economic Union.

Thus, mandatory certification scheme can be introduced in Armenia when the amendment of the EE and RE Law (see sub-section above), draft TR on performance in buildings is approved.

National standard AST 362-2013 Energy conservation. Building energy passport. Basic rules;

As of February 2016, AST 363-2013 is a voluntary standard that officially introduces the calculation methodology and the form of the energy certification of buildings in Armenia. The standard was primarily developed by the UNDP-GEF 'Energy Efficiency in Buildings' project that implemented a number of demonstration projects on improvement of EE in buildings and issued energy certificates for these buildings (see section 'Demonstration' above). As the next step to promote the certification scheme, the UNDP-GEF project offered the construction companies to issue such certificates free of charge. However, without the minimum energy performance requirements set by the government for the new buildings, very few companies showed interest in obtaining the certificate even at no costs.

After the approval of the TR on performance in buildings, this standard can be introduced as mandatory for selected types of buildings according to the decision of the Armenian Government.

Annex 2: Best Practices in EU, examples & lessons learned

Many countries in Europe, in particular former Eastern Block countries, have recently been in the same situation as Armenia with similar building types and with a need for fast implementation of such legislation. A very large experience has been collected in the European Union Member States over the last 20 years. Since the adoption of the Energy Performance in Buildings Directive (EPBD) in 2002 and its recast in 2010 this has been target for comprehensive collaborative policies and development including the development of frameworks and standards. A wide range of lessons can therefore be drawn from these best practices.

Building certification schemes have existed in some European countries for up to 30 years and currently all 28 MS have implemented the EPBD's mandatory EPC requirements and hence have set up building energy performance certification schemes (BPIE, 2010). The lessons learned and experience gained by these countries can be used as good practice examples for countries intending to implement a building certification scheme.

Building energy certificates in the EU have been developed as a key political instrument to assist governments and the building sector in reducing the energy consumption of their building stock. In all MS, they are set up to improve the energy performance of new and existing buildings and to reduce the associated CO2 emissions in buildings, additional direct benefits include environmental benefits, and increased public awareness of energy issues. They also aim to lower energy bills and costs for inhabitants and improve data on buildings.

A labelling scheme is generally used as a tool to promote and raise awareness of the benefits of energy efficiency in buildings. These certificates also help to put energy efficiency on the political agenda and provide information on the building stock for decision makers. Normally, methodologies for developing building energy certificates include the requirement to document the energy performance and identify the savings potential when buildings are sold or rented, for larger public buildings it is a requirement. Additionally, these certificates are used to document compliance rates or better performance in new construction.

All European systems are ambitious and from around ten to a hundred thousand buildings are certified per year. However, many countries have struggled with EPC development and there have been delays because of a sudden implementation of very ambitious systems.

Planning the Certification System

A successful certification system needs to be based on the anticipated benefits of the country and the EPC systems adopted in the MS have been successfully implemented in close connection with key stakeholders. Well-functioning management programmes that include control and monitoring systems are the backbone of the European MS certification systems. The systems aim to ensure that EPCs will increase the market value of energy efficiency in buildings. All European countries that have successfully implemented a certification scheme followed some very basic steps when employing their systems: Plan, Implement, Monitor and Evaluate (IEA Policy Pathway, 2010).

A collective conclusion from MS is that there is a need for different levels of controls when setting up and implementing an EPC, for example: a political authority that sets the rules and defines the ambitions of the scheme, a daily administrator, consultants who are responsible for the certificates,

data collection and quality control (CA EPBD, 2007). These functions must work together to ensure the implementation of the scheme flows efficiently, see figure below.

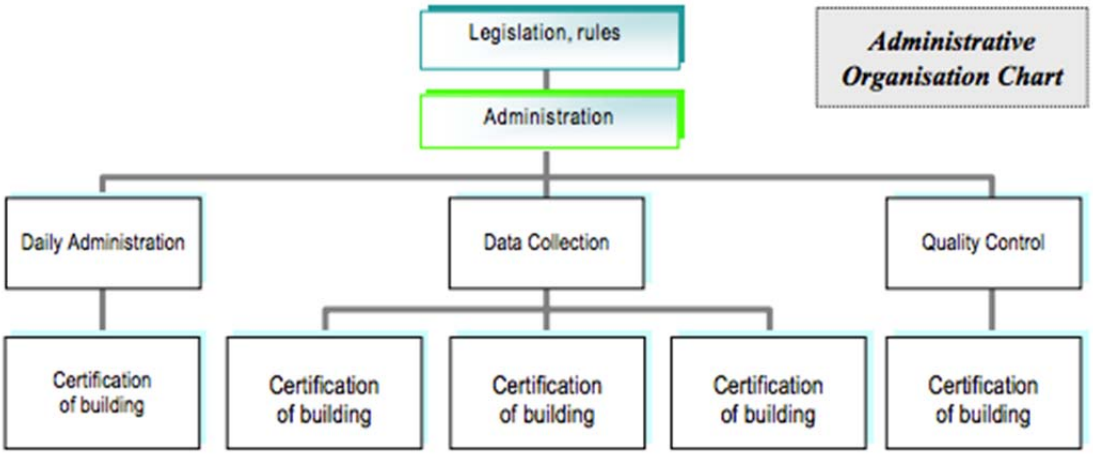

Fig. A2.1. Necessary Functions of a building energy certification scheme (Source: CA EPBD, 2007)

Ensuring that careful planning and realistic timescales are set for each step of the implementation plan are a prerequisite for a successful programme considering all key stakeholders need to be on-board and willing to support the uptake of a robust and successful certification scheme. Some critical points to that must be in place are described below:

- **Define the terms of reference:** the choice of the certificate scheme and the manner in which it is set up must be administered at the early stages of developing the scheme. The scheme should reflect the countries targets and local requirements, taking into account building types, building code requirements and standards.
- **Establish the policy framework and action plan:** When the requirements of the scheme have been established it is then necessary to ensure that coordination and cooperation between the relevant stakeholders is in place, including government bodies and the main actors. The certification framework should follow a clear implementing strategy with milestones, timescales, allocated tasks, and responsibility of assignments. At this stage a group of high-level representatives from the relevant ministries should act as the implementation group and oversee the adoption of the action plan.
- **Secure the necessary resources:** experience from MS in implementing EPC shows that it is crucial to plan and allocate the necessary resources before implementing the scheme to ensure that deadlines are met, these include technical and administrative resources allocated to data collection capabilities, institutional, financial and human.
- **Provide for training:** a number of skill sets are required to ensure high standards and quality of a building-rating programme. In order for a building rating scheme to be operational it requires resources such as training material to ensure assessors have the right skills and knowledge to perform an assessment of a building and parties to monitor and ensure the quality of the certificates.
- **Raise awareness:** Tailored advice and information should be provided to all stakeholders associated with the building sector. This requires the implementation of information campaigns that provide tailored advice and technical information to highlight the benefits of building certification to stakeholders and the general public. Some of the key stakeholders

include the building designers and constructors, real estate, legal and financial bodies, property managers, building owners and parties involved in selling and renting properties.

- **Collect, review and disseminate data:** a comprehensive administration system that incorporates data collection is essential when monitoring and reviewing the certification process and to understand the energy efficiency benefits of the scheme. MS have developed different systems to collect data, however; having a centrally collected data is regarded as an integral step to ensure the certification system is successful.
- **Assess quality and compliance:** A quality assurance system as part of the certification scheme should include training and national examinations of certifiers and auditors. Support for assessors in providing a high-quality service is central to the reputation of the scheme to ensure that compliance with the system is met.
- **Communicate the results:** In order to raise the awareness of the certification scheme and ensure the building industry has confidence in the system, it is important to provide users and stakeholders with the information gathered by the assessment of the buildings. The information can be on cost savings, required investments, feasibility and advice on building improvements.
- **Evaluate the scheme:** after the certification scheme is up and running, countries can then try to maximise the benefits of the system by evaluating the outcomes against the initial objectives of the scheme. The evaluation should focus on the quality of the compliance rates with the building assessments. Calculation methodologies can help with this process.
- **Adapt the scheme as needed:** Additional environmental issues can be assessed using the certification scheme, such as land and water-use, sustainable materials, waste handling, ecology, recycling material, etc. Many European certification schemes take these additional environmental factors into account and use lifecycle and other environmental assessment systems for buildings to determine the building's full impact on energy use.

Case study: Planning and implementation of EPC in Ireland and Portugal

Portugal and Ireland have developed successful systems based on the above principles. They have both fully implemented the EPC requirements set out in the EPBD and are excellent examples of high-quality certification schemes that provide energy performance ratings for both new and existing buildings. Both countries use the energy performance certification schemes to transform the energy performance of their building stock.

In Ireland, the experience gained when implementing its EPC system (called Building Energy Rating) shows that careful planning with the key stakeholders and realistic timescales ensure for a successful certification scheme. In 2003, Ireland set up a joint working group to plan and support the implementation of the EPBD, comprising of senior officials from Ministries and Agencies (SEAI). These working group members facilitated the collaboration with the industry and other key stakeholder to ensure that the implementation of the certification was undertaken in an organized, planned and timely manner that proved to be essential for the implementation of the certification scheme.

Public awareness was raised though involvement and campaigns. The scheme trains and accredits assessors to ensure a high quality of inspection is completed. In new buildings architects and designers use the same assessment procedure as a design tool to integrate energy efficiency into the

planning process of the building design to further support the certification of a building at an early stage.

In Portugal, the key objective for the certification system was to save energy at the same time as ensuring a comfortable indoor climate with adequate indoor air quality. A committee was set up to set up a system to support the objectives and practical implementation of the EPC. The Portuguese Energy Agency (ADENE) is the lead participant and manager of the group and included research institutes, professional associations, universities and other public institutes.

As Portugal had limited experience in certification systems, the committee decided to split the implementation into three phases (Figure 2) to allow for a smooth adaption of their certification system, to provide sufficient training to assessors and to ensure different market actors and authorities were on-board and ready for each step.

	Date
Minimum energy performance requirements came into force	
All new buildings	July 2006
Mandatory energy certification for buildings came into force	
Phase 1: New residential/non-residential (floor area >1 000 m²)	July 2007
Phase 2: All new buildings (regardless of floor area)	July 2008
Phase 3: Existing buildings offered for sale or rent	January 2009
Display certificates in public buildings over 1 000 m²	January 2009
Feasibility assessment of alternative energy systems	January 2007
Energy efficiency of boilers and heating systems	January 2009

Fig. A2.2. Phased implementation of the European EPBD in Portugal in 2006 and 2009, (Source: IEA Policy Pathways, 2010)

Certifying Building types

Certification schemes in Europe rate the efficiency of all types of buildings; most of labels for these building types require a similar set up and layout. Generally, the experience gained in Europe shows that, for all building types, it is necessary to keep the costs of the assessment low whilst keeping the quality, accuracy and reproducibility high. At the same time, it is essential to keep the quality of the certificates high. Often the solutions for the set up of a certification scheme will depend upon the building size, use and whether is a new or existing building. Additionally, the certification scheme should use a standardised approach and tools such as calculation and registration systems that support the certification procedure all way through to printing and uploading. Whilst the methodology and application of certificates for new and existing buildings may differ, both require robust procedures.

Energy certification of a new building in the European Union often demonstrates the compliance with the national building code and is a means of incentivising a better efficiency standard of building, compared to similar buildings. All European MS require building certificates for new buildings at the time of construction to ensure their compliance with the building code, the certificate clearly defines the class in which the building falls and hence shows whether or not the building has exceeded the minimum standard. The certification of new buildings can further and has supported contractors and users in European countries to go-beyond the minimum standard.

For existing buildings, the certification can assess the performance and provide information on the efficiency of the building type. This makes it possible to compare the standards of different buildings when on sale or rented, making it easier for the consumers to make the right choice. With the regular certification of large buildings, it becomes possible to track the change in performance and support good energy monitoring. European practice shows that certificates facilitate the comparison of new and existing buildings and thus encourages greater energy efficiency in existing buildings (EPBD Public Consultation, 2014).

Case Study: Certifying Building Types in Denmark

Denmark is regarded as a pioneer in mandatory building energy labels and a system has been in place since 1997; the Danish Energy Labelling Scheme for existing buildings. This scheme served as the primary model for the EPCs required by the EPBD. The success of the Danish certificates comes from understanding the difference between new and existing buildings and different building types and from collaboration with all the important stakeholders. Existing buildings certificates must not be over 5 years old, covering fourteen efficiency levels (high, A1, to low, G2), whereas new building certificates must meet the requirements of the building code and must not be lower than a B1 efficiency level. Today a very large part of the buildings are registered in the central database, which is public accessible for all key information. This database ensures direct interaction between all stakeholders.

Compliance with requirements

One of the great challenges faced by MS when developing their certification schemes is ensuring the compliance with demands when presenting the certification when buildings are set to sale, as the mechanisms to check advertising is complex. This is a new demand in the recast of the EPBD directive of 2010.

Countries have found different ways to ensure that energy certification is undertaken before the building is set to sale by:

- Requiring on-site inspection during and after the construction process
- Providing adequate training to inspectors, including the requirement for a qualification to inspect
- Imposing a monetary fine
- Recertification or suspension of the certifier's licence
- Setting up independent control systems
- Spot checks on assessors and buildings

The quality assurance of EPCs and certification mechanisms is deemed by the MS as the most important aspect for the successful implementation of the certificate system, as the credibility of the schemes can be destroyed if the certificate quality is low and will prevent the future use of EPCs in a country (CA EPBD, 2013). The quality of a certification scheme depends on a broad range of factors that are part of the implementation process, including qualifications of the certifiers, the methodological framework and software tools, approach to the collection of input data, etc. Figure A2.3 below shows the steps the MS follow to ensure compliance with the certification methodology.

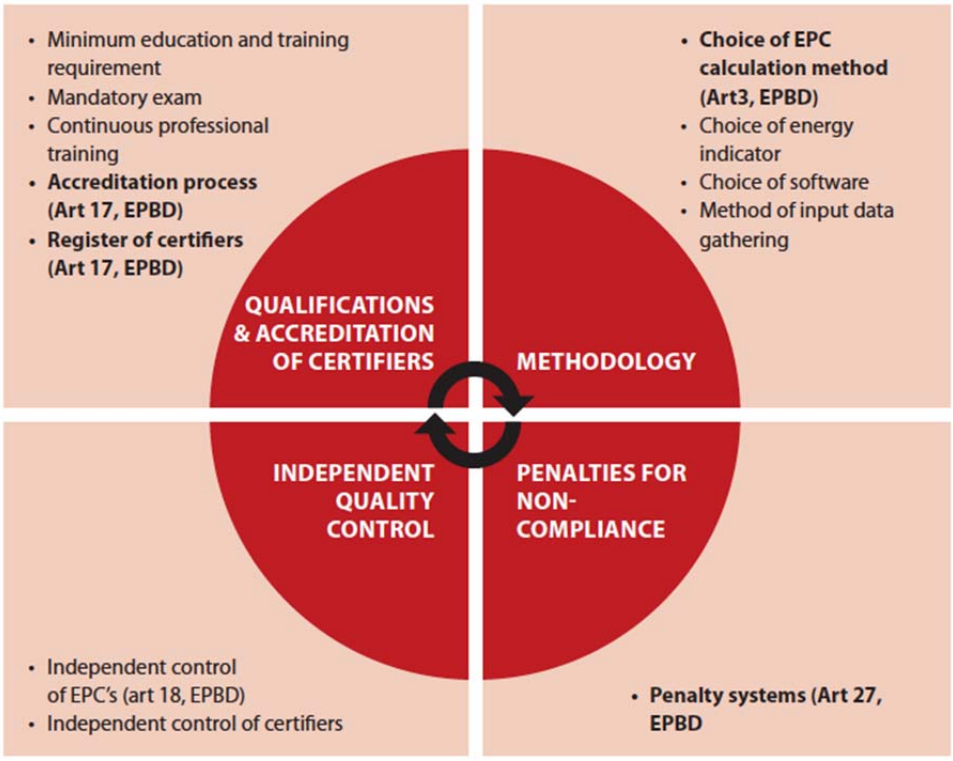

Fig. A2.3. Elements of the quality assurance of EPC systems. (BPIE, 2010)

The EU MS broadly agree that the competence of the certifier is one of the most influential factors that determines the quality and cost of the certificate (CA EPBD, 2011) and 20 of the 28 MS have opted to set a compulsory exam that checks the certifiers' level of competence. In over half of the MS, training of the certifiers is a requirement; other programmes are set up in MS to support the continuous professional development of the certifiers. The methods MS have chosen to verify the measures taken vary, some have opted to choose a random selection methodology that checks a significant percentage of the certified buildings per assessor, others use a random sampling methodology that checks all of the EPCs issued.

The MS have chosen different methodologies to penalise the buildings/developers that do not comply with the building code. Some EU MS have opted to impose a monetary fine while other have chosen to pose an administrative penalty such as a formal warning, a suspension of the building permit or the recertification or suspension of the certifier's licence. (BPIE, 2014)

Case study: Compliance of Certificates in Ireland

Ireland's auditing process involves three types of control to ensure compliance is fulfilled, these include:

1. *Weekly data reviews;*
2. *Desk reviews;*
3. *Documentation and practice audit.*

The weekly data review is a high-volume desk-based system that highlights inaccuracies. The desk review audits is a medium-volume desk-based system by a specialist who undertakes a forensic review of assessments, this may lead to an assessor notification. Finally, the audits (low-volume) are carried out by an assessor appointed by SEAI who undertakes an on-site visit, and, in the case of non-compliance, several disciplinary actions could be taken in the form of penalty points, fines and eventual termination of registration as assessor from the system.

Databases and certification

Database-centred systems are a prerequisite for the management of energy performance certificates and the data acquired. Databases require minimum effort and costs and allow for transparency and fraud prevention. In order to further support the monitoring and quality control process of the energy performance certificates, to date, 24 MS have established centralised EPC registers. The registers vary with regards to the data collected, the format and access rights. MS see central registers as a way to yield a comprehensive data repository on the energy performance of the building stock and they widely agree that a central database is the essential foundation of a useful procedure for monitoring the information collected (CA EPBD, 2013).

As users and owners pay for the certification of their buildings, this includes the costs for registration and for all part of the training of experts. Governments are provided with a large amount of insights and information on their country's building stock at very low, even negligible costs. An EPC can, hence, deliver cost neutral support for energy policy development for the energy performance in buildings. The databases set up to collect the data of the certification scheme can further function as evaluation tools for policy development, as the stock entered in systems is constant and often directly comparable.

Robust and ambitious energy certification schemes provide decision makers in the building and property sector with trusted information on the building stock and hence aids governments in realising national energy and CO2 targets. Additionally, MS have seen added benefits linked to environmental social and economic sustainability in the building sector. In some MS that have a long history in building certification, a positive impact on the real estate market has been recorded.

Case Study: Databases and certification in Portugal in Ireland

In all case studies in Portugal, Ireland and Denmark central databases help to ensure quality but also to gain information from these certifications.

In 2007, Portugal established an EPC central database in order to ensure the certification process is monitored and complied with. ADENE developed the integrated web-based system on their website that provides users, assessors and owners easy access to the certification data. Over the years, the database has been updated with up-to-date information from all Portuguese certified buildings. This acts as the national database of energy use in buildings that is used to undertake periodic quality

control checks of on assessors and certificates, assessor audits are also a fundamental part of the Portuguese compliance system and are undertaken once every five years.

The Irish EPC database is very comprehensive and well-established. It collects information from all over the country and its interface is located on the SEAI website.

Issued, operated and maintained by the SEAI, the EPC-issuing software and database permits for harmonized operation of the EPC process, from training the assessors and workforce to running quality checks on the data. Both building owners and assessors access information in this database and it can be used to contact an expert, receive information on improving the energy efficiency of their household and check the rating of a building. The system is further used for a one-stop-efficiency-rating shop, enables national energy statistics that can be used to analyse policies and the building stock.

Linking certificates to supporting and complimentary policies and measures

When analysing the existing schemes in Europe it becomes apparent that the most secure manner of ensuring certification schemes adhere to their targets and achieve the intended impact is by linking supporting measures to the certificate. The impact of the certification scheme can be increased when linked to supporting measures such as energy requirements in building codes and financial incentives.

By linking building codes and certification schemes, builders, designers and the construction industry can be incentivised to incorporate energy efficiency into the design process of new and renovated buildings. This can lead to greater energy savings in a cost-effective manner. Financial incentives can be linked to this scheme to further encourage energy saving measures.

Certification can also be used as a means to identify the most cost-effective energy saving measures a building should undertake. A broad range of financial instruments exist in Europe and many MS use their EPCs as a means of accessing finance to support energy efficiency in buildings. Many countries go beyond the minimum standards for building codes as a condition to receive financial support; the EPC is submitted and used as proof of this higher energy standard.

Case study: Linking Certification to supporting and complementary measures in Denmark

Lessons learned from the Danish Energy Authority show that "energy certification does not deliver alone, but that such systems need to be supported by other measures in order to become efficient". A study in the UK confirms this, revealing that 32% of home-buyers carry out energy improvements within months of buying their house and receiving their energy certificate.

Methodology for calculating energy performance: Calculated vs. Measured

During the second mission in November 2015, the ITS experts were asked to provide brief information on the EU experience with respect to the methodology for calculating energy performance as well as benefits and disadvantages of calculated and measured energy consumption.

In many European countries calculated energy consumption (asset rating) is used for new construction and for smaller buildings such as single family houses, as these are highly influence by

the habits of the user, which change by sale or rental. Metered consumption (operational rating) is on the contrary often used for large existing buildings and by the regular rating of public buildings as the inclusion of behavioural aspects are seen as beneficial in these buildings as the occupancy rarely change or only slowly change in large residential buildings.

Both the calculated and the metered consumption are therefore used in most of the EU countries, but for different types of buildings. The reasons are that calculated consumption is good in establishing what this building would be supposed to consume without influence of behavioural aspects, which is useful especially when the whole occupancy change (such as single houses by sale), while metered consumption include the behaviour, which is useful when you look for the change in consumption (for instance in a large public building). Many countries also found the collection of information and data for a calculation (asset rating) of energy consumption in a large existing building could be a very time consuming exercise, which actually didn't pay off by the end of the day. Most countries therefore today use operational rating based on metered consumptions for such existing buildings.

Calculated energy (asset rating) is good when you compare one building with another, while metered consumption (operational rating) is good when you compare the development over time. Calculated energy is good to estimate theoretical savings by improvement of building shell or technical systems while metered consumption is good when you want to include behavioural aspects. Most European countries agree on these main differences and take this into account in the systems.

In some cases calculated and metered consumption is used in the same buildings. Comparison of these can help to identify behavioural aspects or even mistakes in the construction or by the settings or maintenance of systems.

Case study: Calculated vs Measured Energy Consumption in Ireland

The Dwelling Energy Assessment Procedure (DEAP), the official methodology for calculating energy performance in Ireland uses calculated or 'standardised operating conditions' for calculating energy performance;

DEAP allows prospective buyers or tenants to objectively compare the energy performance of different dwellings on a like for like basis. DEAP is an asset (calculated) energy rating rather than an operational (measured consumption) rating. The key differences between calculated energy consumption and measured energy consumption are as follows:

Calculated Energy Consumption

Key features:

- *›Calculate energy usage based on the dwelling NOT the occupants – like MPG rating for cars the actual driving style, terrain and conditions not accounted for*
- *›Consistent assumptions made for all dwellings such as:*
- *›Same level of lighting required in all dwellings*
- *›Number of occupants and hot water demand based on floor area*
- *›Fixed length heating season and fixed heating periods per day*
- *›Dwelling heated to fixed temperatures*
- *›Climate*

Some pros:

- *›Allows all dwellings to be compared on like for like basis*

›The prospective buyer or tenant is not dependant on current occupier behaviour
›Ideal for dwellings being sold or rented
›Ideal for evaluating the building for regulatory purposes

Some cons:

›If the occupant is frugal or wasteful in their energy usage, their energy bills could be much smaller or larger than the asset rating would indicate
›Requires detailed survey of dwelling fabric and heating system

Measured Energy Consumption

Key features:

›Measures actual energy usage
›Can be based on bills and/or monitored data
›No need to identify building components
›Standardised assumptions not relevant

Some pros:

›Reflects actual energy usage
›Does not require detailed survey of dwelling fabric and heating system

Some cons:

›Difficult for prospective buyer or tenant to compare on like for like basis
›Highly dependent on behaviour of occupants
›Not suitable for demonstrating compliance with regulatory requirements as home must be occupied to enable measurement of energy consumption

Source: Introduction to DEAP, http://www.seai.ie

Annex 3: EPB Standards

The list of standards was presented by the Danish Building Research Institute within INOGATE Combined event on EBPD in December 2015, Author: Soeren Aggerhom

Overarching Standard, OAS

ISO/DIS 52000-1 Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures.

General

EN ISO 52003-1 Energy performance of buildings – Indicators, requirements and certification – Part 1: General aspects and application to the overall energy performance.
EN ISO 17772-1 Indoor environmental input parameters for design and assessment of energy performance of buildings- addressing indoor air quality, thermal environment, lighting and acoustics – Part 1 Standard.
EN ISO 52010-1 Energy performance of buildings – Overarching Assessment Procedures. External environment conditions – Part 1: Calculation Procedures.
EN 15459-1 Economic evaluation procedure for energy systems in buildings.

Building

EN ISO 52016-1 Energy performance of buildings – Building and Building Elements – Calculation of Sensible and Latent Thermal Energy Needs in a Building or Building Zone – Part 1: Calculation Procedures.
EN ISO 52017-1 Energy performance of buildings – Building and Building Elements – Calculation of the Dynamic Thermal Balance in a Building or Building Zone – Part 1: Detailed procedures.
EN ISO 52018-1 Energy performance of buildings – Building and building elements – Ways to Express Energy Performance and Energy Performance Requirements – Part 1: Expressions and Procedures.
EN ISO 13789 Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method.
EN ISO 13370 Thermal performance of buildings – Heat transfer via the ground – Calculation methods.
EN ISO 6946 Building components and building elements – Thermal resistance and thermal transmittance – 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 ISO 10077-1 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General.
EN ISO 10077-2 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames.
EN ISO 12631 Thermal performance of curtain walling – Calculation of thermal transmittance.
EN ISO 13786 Thermal performance of building components – Dynamic thermal characteristics – Calculation methods.
ISO NP 10913 Calculation methods for the determination of air flow rates in buildings including infiltration.
EN ISO 52022-3 Energy performance of buildings – Building and Building Elements – Solar and Visual Characteristics – Detailed calculation method.
EN ISO 52022-1 Energy performance of buildings – Building and Building Elements – Solar and Visual Characteristics – Simplified calculation method.

Heating, DHW and energy supply

EN 15316-1 Energy performance of buildings - Heating and DHW systems in buildings – Part 1:

General and Energy performance expression.
EN 12831-1 Heating systems in buildings — Method for calculation of the design heat load.
EN 12831-3 Domestic hot water systems heat load and characterisation of needs.
EN 15316-2 Energy performance of buildings – Space emission systems (heating and cooling).
EN 15316-3 Energy performance of buildings – Distribution systems (DHW, heating and cooling)
EN 15316-5 Energy Performance of Buildings – 5-1: Storage systems for heating and domestic hot water
EN 15316-4-1 Energy performance of buildings – Heating and DHW generation systems, combustion systems (boilers, biomass).
EN 15316-4-2 Energy performance of buildings - Heating systems – Part 4.2:1: Generation and control – Heat pumps systems.
EN 15316-4-3 Energy performance of buildings – Heat generation systems, thermal solar and photovoltaic systems.
EN 15316-4-4 Energy performance of buildings – Heat generation systems, building integrated cogenerations systems.
EN 15316-4-5 Energy performance of buildings – District heating and cooling
EN 15316-4-8 Energy performance of buildings – Heating systems and water based cooling systems in buildings – Space heating generation, air heating and overhead radiant heating systems, stoves (local).
EN 15378-3 Energy performance of buildings – Heating and domestic hot water measured energy performance.
EN 15378-1 Energy performance of buildings – Heating systems in buildings – Inspection of heating and domestic hot water systems.

Ventilation and cooling
EN 16798-9 Energy performance of buildings – Part 9: Ventilation for buildings – Calculation methods for energy requirements of cooling systems – General.
EN 16798-11 Energy performance of buildings – Calculation of the design cooling load.
EN 16798 – 15 Energy performance of buildings – Calculation of cooling systems – Storage – General.
EN 16798-13 Energy performance of buildings – Calculation of cooling systems – Generation.
EN 16798-17 Energy performance of buildings - Ventilation for buildings - Guidelines for inspection of ventilation and air conditioning systems.
EN 16798-3 Energy performance of buildings – Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems
EN 16798-7 Energy performance of buildings – Ventilation for buildings – Calculation methods for energy requirements of ventilation and air conditioning systems – Part 7: Emission (determination of air flow rates).
EN 16798-5 Energy performance of buildings – Ventilation for buildings – Calculation methods for energy requirements of ventilation and air conditioning systems – Part 5-1: Distribution and generation – Method

Lighting
EN 15193-1 Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications

Automatic and controls
EN 15232 Energy performance of buildings – Contribution of Building Automation, Controls and Building Management.
M10-11 ? Energy Performance of Buildings – Inspection for Building Automation and Control.
M10-12 ? Energy Performance of Buildings – Building Management System.

Source: Danish Building Research Institute, SBi, Soeren Aggerhom, December 2015

Annex 4: Overall Road-Map for the implementation of EPC

	Clarification / Concept	Development of systems	Training of Experts	Implementation	Evaluation	Successive Upgrades
Overall System	Central questions on scope, which are mandatory etc.	Development of procedures	Training in key parameters	Information for the public	Evaluation of system	Decision on upgrades and implementation
Certificate	Central decisions on certificates and need for adaptation	Development of certificates and scales		Registration of certificates	Evaluation	Implementation in changes in certificate
Calculation	Check on need for change and new development	Development of calculation procedures and tools	Training in use of tools			Improvements of calculation methodology
Frame Work	Decisions on set up and responsibilities	Development of databases, quality control		Quality Control	Evaluation of framework and quality	
Indicators	Development of action plan / roadmap	Design and adaption of systems, tools and rules	Number of trained experts	Number of certificates, knowledge to system	Evaluation report and decisions on actions	Implementation of changes Improved satisfaction

Annex 5. Example of the Stage 1 of the Road-Map for the implementation of EPC in new buildings

Stage 1. Clarification and Concept	Timeframe	Responsible Authorities
Overall System		
1.1 Decide whether the mandatory certification should be introduced for all new buildings or for the certain type of new buildings, i.e. multiple-dwelling buildings, governmental buildings etc.	March-April 2016	MUD
1.2. Identify the main purpose of the certification scheme, for example: - EPC should confirm the compliance with the minimum energy performance requirements of the building code; - EPC should encouragement to go beyond minimum requirements in order to get higher rating and thus attract increase value of the building;	March-April 2016	MUD and MoENR
1.3. Adopt new minimum energy performance requirements for new buildings, i.e. adopt a new building code. Set minimum energy performance requirements for different types of new buildings, including the following: - The minimum energy performance requirements should be aligned with Energy Performance Certification Scheme. - The tightening of minimum energy performance requirements should be established from the beginning. For example, the new buildings should comply with the requirements for the following energy classes: o 'C+' from 01.01.2017 o 'B' from 01.01.2019 o 'B+' from 01.01.2021, etc Involve industry in the discussion of cost-effective minimum energy performance requirements.	April – October 2016	MUD, MoENR and Ministry of Economy
1.4. Envisage appropriate period of time between the approval of the EPC legislation and the date of entering it into force. As an example, mandatory certification of buildings should enter into force : - for buildings selected at stage 1.1. – not earlier than 1 year after the approval of EPC legislation;	April – October 2016	MUD, MoENR and Ministry of Economy

- for other new buildings – not earlier than 2 years after the approval of EPC legislation; - for existing buildings – not earlier than 3 years after the approval of EPC legislation.		
1.5. Decide about the general qualification criteria for potential assessors.	August-October2016	MUD, MoENR and Ministry of Economy
Certificate		
1.6. Decide on the form of the certificate for the buildings selected at stage 1.1. Analyse the previous experience in issuing energy certificates for pilot projects in Armenia (What worked well? What is easy to understand and what needs improvement/further explanations?) Analyse the design of the existing certificates in EU MS.	May – October 2016	MUD, MoENR, Ministry of Economy
1.7. Align the scales of the certificate with minimum energy performance requirements established at stage 1.3.	May – October 2016	MUD, MoENR, Ministry of Economy
Calculation		
1.8 Decide whether the existing standard AST 362-2013 “Energy conservation. Building energy passport” is sufficient for the buildings selected at stage 1.1. Identify new elements that need to be developed. Review international standards (see in Annex 3), identify the ones that can support the rating. Adopt the identified standards in Armenia.	May – December 2016	MUD, MoENR, Ministry of Economy “Energy Research Institute” CJSC
Frame Work		
1.9. Establish the Authority responsible for the implementation of EPC in Armenia, for example: National Energy Agency for EE and RES, the creation of which was envisaged in the 1st NEEAP. Assign roles and responsibilities of the Agency. Identify roles of the other ministries and organisations.	March –December 2016	MUD, MoENR, Ministry of Economy