D4.3 PILOT PROJECTS APPLICATION REPORT - GREECE

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QualitEE Project

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The QualitEE consortium comprises 12 partner organisations covering 18 European countries, an expert advisory board, including the European standards body CEN/CENELEC, and 59 supporters from major financial institutions, government bodies, trade associations and certification bodies.

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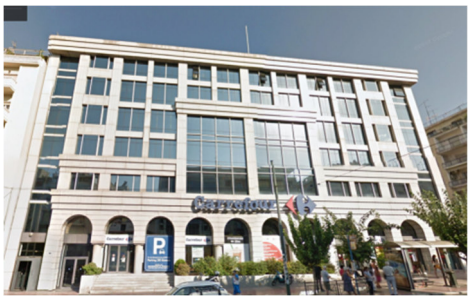
Contents

1 INTRODUCTION

During the project activities, quality criteria have been applied for new projects. Technical quality criteria and Financial Guidelines have been applied in new pilot projects. Partners have provided support to clients or ESPs from the procurement phase until the first measurement and verification phase if possible. Report follows the pilot project implementation in quantitative and qualitative manner and extract lessons learned.

During this report pilot project are described and description how and which technical and financial criteria had been used. Feedback on the application has been collected with the aim to refine and improve operationalised technical quality criteria and financial guidelines and to provide real-world insights and advice on the establishment of national certification frameworks.

2 DESCRIPTION OF PILOT PROJECT #1



2.1 Pilot project factsheet

Project details:

- The project consists of the implementation of energy efficiency measures within the central offices of the Hellenic Natural Gas Company, a Greek Energy Company that supplies both electricity and natural gas to its clients. The central offices occupy the 5th floor of a 5-storey building in the centre of Athens (108 Kifissias Avenue).
- The project has been operational since November 2019 and is currently in the Monitoring and Verification phases
- The main objective is to test some of the QualitEE criteria in the Energy Performance Contract of the project. The implemented energy efficiency measures consist of the thermal zoning of the existing heating and cooling areas.

Table 1: Energy Consumption Data

Energy Consumption BEFORE intervention (actual) kWh/a	Energy Consumption AFTER intervention (actual) kWh/a	Value of planned EE investment EUR
195,329	173,973	4,000

Energy upgrade of the heating and cooling system

1,792 m^2 office floor in Athens

This project saves:

14.25 tCO2 emissions per year

Annual energy savings (13%):

21,350 kWh/year

Annual primary energy savings:

44,800 kWh/year

Business case description/economic parameters

- The project was financed by own funds of the energy service provider and an Energy Performance Contract was signed
- The investment for the implementation of the project amounted to € 4,000 and the value of the Energy Performance Contract was € 6,000.

Stakeholders/companies involved

Hellenic Natural Gas Company (Client)

HELESCO S.A. (Energy Service Provider)

Centre for Renewable Energy Sources and Saving (Facilitator)

2.2 Technical aspects

Before building renovation

The central offices of the client, the Hellenic Natural Gas Company, occupy the whole 5th floor (1,792 m^2) of an office building in the centre of Athens, Greece. The offices consist of meeting rooms, a reception area, individual offices and a large open-floor area for the Call Centre. The building does not neighbour with any other buildings and all its facades are subject to the environment. As a result of this and the large windowed surfaces, temperatures within the floor can vary considerably according to the orientation.

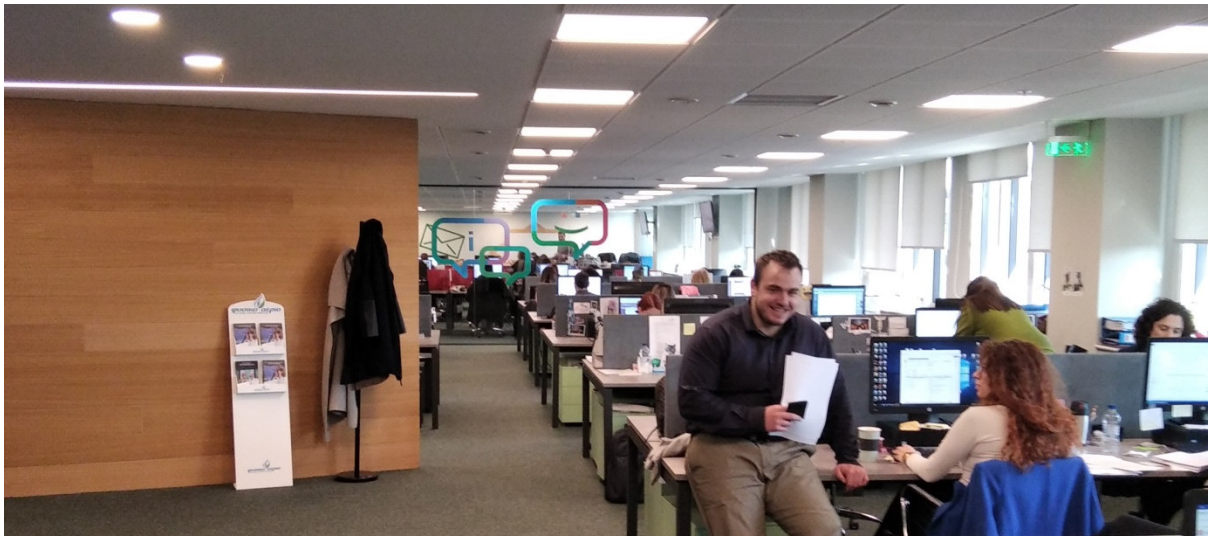


Photo 1: View of the 5th floor offices of the Hellenic Natural Gas Company

The floor was heated and cooled by Fan Coil Units (FCUs) located under the windows of the perimeter walls. During the heating period the FCU's are supplied with hot water 50 ^{0}C from the central boiler of the building located in the boiler room of the 1st underground floor whilst during the cooling period, the FCU's are supplied with cold water 7 ^{0}C from the central chiller of the building located on its roof. Each individual FCU was controlled manually by the floor users. As a result of this, internal temperature conditions were very irregular (e.g. too high or with considerable variation even between neighbouring spaces).

Renovation process

In order to improve the irregular use of the FCU's, it was decided to separate the floor into four (4) distinct thermal zones (with a total area of 1,254 m^2) and to group the FCU's in each of these thermal zones. These were re-wired and a control system installed that centrally controls the set-point temperature and operation of each group of FCU's. The implementation of the project took approximately 1 month and the total investment cost was € 4,000.

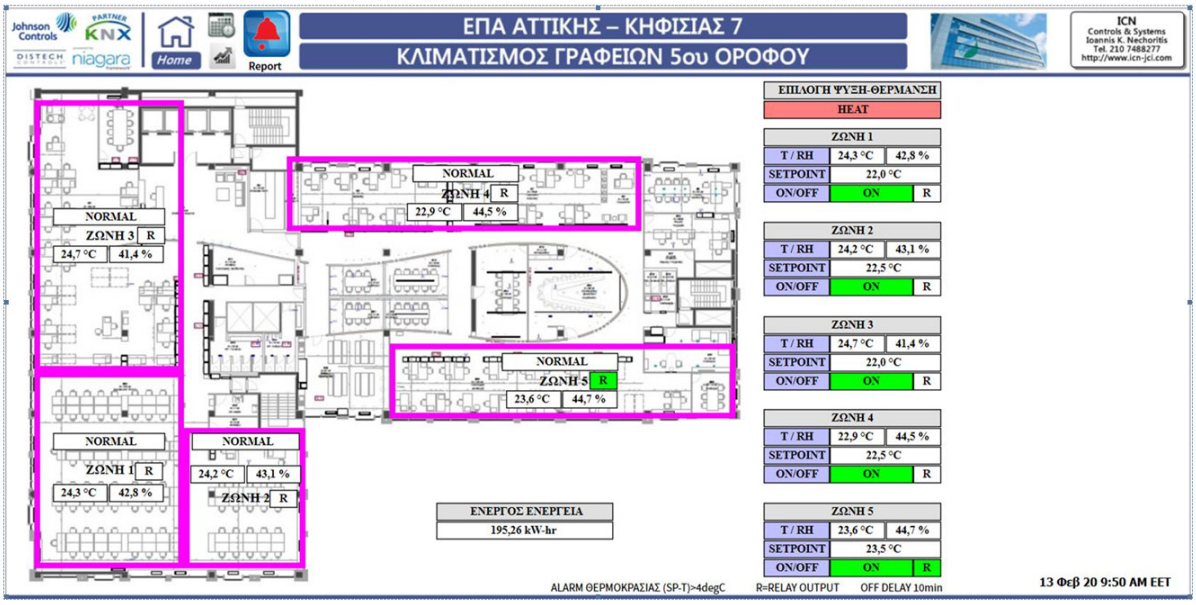


Figure 1: Thermal Zones, temperatures and set-points of the 5th floor offices of the Hellenic Natural Gas Company

After renovation and results achieved

For the measurement and verification of the energy savings the IPMVP Method D was used with some minor elements of Method B (i.e. the electrical consumption of the FCU's is measured), mainly due to the absence of any type of metering and the reluctance of the other building occupants to install new meters and redesign their methodology for the allocation of heating and cooling costs. As a result of the implemented energy efficiency measures, approximately 20% of energy savings were achieved for heating and 8% for cooling. Furthermore, the thermal comfort of the floor improved considerably as there is now a more uniform range of temperatures.

Photo 2: Installed control system and electrical energy measurement system

3 DESCRIPTION OF PILOT PROJECT #2

3.1 Pilot project factsheet

Project details:

- The project consists of the implementation of energy efficiency measures within the retail shop of "Parabita S.A" located on 45 Ermou Street in central Athens.
- The project has been operational since November 2017 and is currently in the Monitoring and Verification phases.
- The main objective is to test some of the QualitEE criteria in the Energy Performance Contract of the project. The implemented energy efficiency measures consist of the re-design of the existing indoor lighting installations.

Table 2: Energy Consumption Data

Energy Consumption BEFORE intervention (actual) kWh/a	Energy Consumption AFTER intervention (actual) kWh/a	Value of planned EE investment EUR
8,726.9	4,665.4	4,000

Re-design of the indoor lighting **103 m^2** retail clothing shop in Athens

This project saves:

4,02 tCO2 emissions per year
Annual energy savings (47%):
4,061.5 kWh/year
Annual primary energy savings:
11,780 kWh/year

Business case description/economic parameters

- The project was financed by own funds of the energy service provider and an Energy Performance Contract was signed
- The investment for the implementation of the project amounted to € 4,000 and the value of the Energy Performance Contract was € 2,600.

Stakeholders/companies involved

Parabita S.A (Client)
HELESCO S.A. (Energy Service Provider)
Centre for Renewable Energy Sources and Saving (Facilitator)

3.2 Technical aspects

Before building renovation

The retail clothing shop of the client, Parabita S.A, is located on the pedestrians-only Ermou Street in Central Athens. It consists of a small clothing shop of 103 m^2 that sells women's clothing. The indoor lighting fixtures of the shop consisted of recently installed LED luminaires that were installed during a re-lamping energy efficiency measure implemented by the client. During the energy audit that was implemented by the energy service company, it was noted that the quality of lighting was of poor quality. This was due to the fact that many lighting fixtures directed excessive light to areas of the shop where lighting was not necessary.

Photo 3: View of the quality of lighting before the renovation

Renovation process

In order to improve the quality of lighting and to also improve the energy performance of the shop the following measures were implemented:

- Turning off the "hidden" fluorescent luminaires located on the ceiling during the hours in which the shop is not operational.
- The transfer of the rails bearing the LED downlights inwards and lower in order to improve the lighting of the clothes.
- The dimming of the LED downlights by 40% due to their increased vicinity to the clothes as a result of the transfer of the rails.

- The installation of two new spotlights on the rails. These direct light onto the ceiling and this light is then reflected uniformly downwards. These substitute the hidden lighting fixtures that are turned off during the non-operational hours of the shop.
- The replacement of the ceiling spotlights with new anti-glare spotlights with increased luminosity for the improved lighting of the central aisle of the shop.

The implementation of the project took approximately 1 weekend and the total investment cost was € 4,000.

Photo 4: View of the quality of lighting after the renovation

After renovation and results achieved

For the measurement and verification of the energy savings the IPMVP Method A was used with yearly measurements. As a result of the implemented energy efficiency measures, approximately 47% of electrical energy savings were achieved for lighting. Furthermore, the visual comfort of the shop improved considerably as there is now a more uniform and efficient quality of lighting in the shop.

Photo 5: Installed electrical energy measurement system

4 DESCRIPTION OF PILOT PROJECT #3

4.1 Pilot project factsheet

Project details:

- The project consists of the implementation of energy efficiency measures within the central offices of the ETHER Applications Ltd Company, a Greek Energy Company that provides efficient energy solutions by designing, installing and commissioning energy-related systems (steam generators, energy meters, metal chimneys, energy information systems,etc.). The central offices are located on 19.7km Markopoulou Ave. in the area of Peania in Attiki.
- The project has been operational since May 2019 and is currently in the 1st Monitoring and Verification phases
- The main objective is to test some of the QualitEE criteria in the Energy Performance Contract of the project. The implemented energy efficiency measures consist of the upgrade of indoor lighting system.

Table 3:Energy Consumption Data – Lighting System

Energy Consumption BEFORE intervention (actual) kWh/a	Energy Consumption AFTER intervention (actual) kWh/a	Value of planned EE investment EUR
13,695	5,914	3,700

Energy upgrade of the indoor lighting system in **171 m²** office floor area of Paiania in Attiki.

This project saves:

7.7 tCO2 emissions per year
Annual energy savings (57%):
7,781 kWh/year
Annual primary energy savings:
22,565 kWh/year

Business case description/economic parameters

- The project was financed by own funds of the energy service provider and an Energy Performance Contract was signed
- The investment for the implementation of the project amounted to € 3,700 equal to value of the Energy Performance Contract.

Stakeholders/companies involved
ETHER Applications Ltd (Client)
INTRACOM TELECOM (Energy Service Provider)

4.2 Technical aspects

Before building renovation

The central offices of the client, ETHER Applications Ltd, are located on 19.7km Markopoulou Ave. in the area of Peania in Attiki. The offices consist of a reception area, individual offices and a meeting room. The offices are located at the ground floor of a building, where because of the lack of physical lighting, the lighting system is used at the 100% of its capacity (in total 10 hours/ day for 251 days per year). The indoor lighting system of the offices consisted of fluorescent luminaires. During the energy audit that was implemented by the energy service company, it was noted that there was a poor light diffusing, fact that led to a poor lighting quality.

Photo 6: Offices of the ETHER Applications Ltd

Renovation process

In order to improve the quality of lighting and to also improve the energy performance of the offices the following measures were implemented:

- Replacement of the existing fluorescent luminaires with LED luminaires, with the same geometric and photo technical characteristics
- Modification of power lines for lighting fixtures
- Installation of energy meters for measurements of lighting system energy consumption

The implementation of the project took approximately 1 month and the total investment cost was € 3,700.

Before (4x18W fluorescent)

After (38W LED panels)

Photo 7: View of the lighting system before and after renovation - ETHER Applications Ltd

After renovation and results achieved

For the measurement and verification of the energy savings the IPMVP Method B is using, as because of the installation of energy meters savings are quantified by field measurement of the actual energy use of the lighting system continuously, throughout the reporting period. Adjustments are also taken into consideration wherever there are changes in conditions of baseline consumption determination (changes of the number of luminaires, working hours and days). As a result of the implemented energy efficiency measures, approximately 57% of energy savings were achieved for lighting. Furthermore, the lighting comfort of the offices improved considerably mainly due to better light diffusing of the new lighting system.

Photo 8: Modification of power lines for lighting fixtures

Photo 9: Installation of energy meters

5 FEEDBACK ON QUALITY CRITERIA

Feedback from pilot projects was collected in the form of a questionnaire. It contained identical questions for each quality categories and some open-ended questions to collect qualitative information. For closed questions a limited number of options were given, and respondents were asked to evaluate quality criterion category separately. All nine quality criteria impact categories have been analysed. The impact categories are given in Figure 2 below.

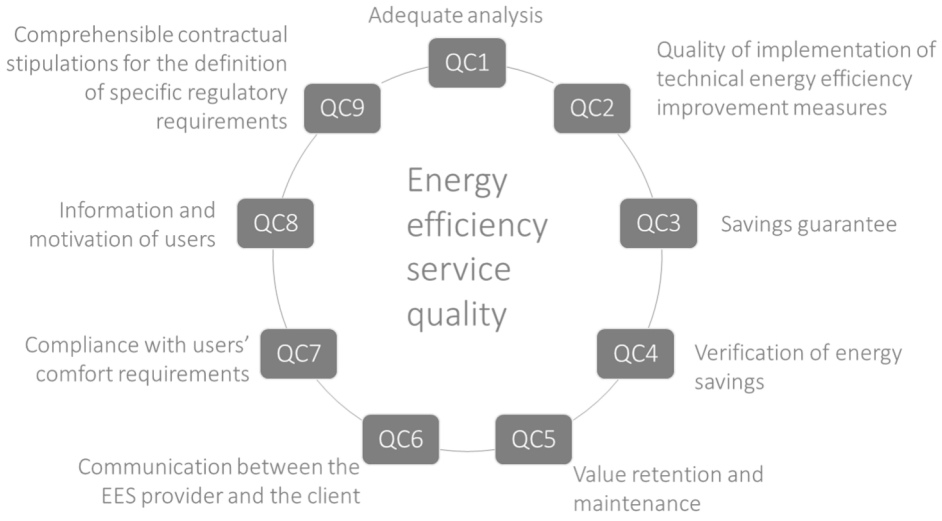


Figure 2: Categories of quality criteria

The main questions for each criterion are as follows:

1. How **important** is this criterion in assessing the quality of EES?
2. Is the criterion **specific** enough?
3. Is it possible to provide **evidence** (documents, references in contracts, measured data etc.) to assess the criterion?
4. How **time consuming** is the assessment of this criterion?
5. How many criteria have been used in the project?

The first question was asked to evaluate how important the particular criterion is.

5.1 Importance of the criterion

Respondents have been asked to evaluate which are the most important criteria? As most important criteria by client side have been considered:

1. Savings guarantee
2. Quality of implementation
3. Verification of energy savings

from ESCO side:

1. Adequate analysis
2. Savings guarantee
3. Verification of energy savings

and from Facilitator/FI side:

1. Verification of energy savings
2. Adequate analysis
3. Quality of implementation

5.2 Was the criterion specific enough?

Participants were asked to evaluate each impact category by rating them from not specific (1) to very specific (5). The average of the answers have been summarized in Table 4 -

Table 6Error! Reference source not found. below.

Table 4: Specificity of criteria – Hellenic Natural Gas Company

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	5.0	5.0	5.0	5.0	5.0	Not used	Not used	5.0

Table 5: Specificity of criteria – Parabita

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	5.0	5.0	5.0	5.0	5.0	Not used	Not used	5.0

Table 6: Specificity of criteria – ETHER Applications Ltd

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	5.0	5.0	5.0	5.0	5.0	Not used	Not used	5.0

5.3 How easy is it to provide evidence?

Feedback was also collected with the aim to evaluate the ease of availability of evidence – documents, references in the contract, measured data etc. – to assess a specific criterion. Respondents were asked to evaluate each impact categories and the possibility to provide evidence by rating each criterion from not possible at all (1) to easily possible (5). The answers have been summarized in Table 7- Table 9.

Table 7: Availability of evidence – Hellenic Natural Gas Company

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	3.7	5.0	5.0	3.3	3.0	Not used	Not used	5.0

Table 8: Availability of evidence – Parabita

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	3.7	5.0	5.0	3.0	2.7	Not used	Not used	5.0

Table 9: Availability of evidence – ETHER Applications Ltd

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	5.0	5.0	5.0	5.0	5.0	Not used	Not used	5.0

5.4 How time consuming is the assessment of the criterion?

Respondents rated each impact categories from very time consuming (1) to not time-consuming (5). Answers have been summarized in Table 10- Table 12 below.

Table 10: Time taken for evaluating criteria - Hellenic Natural Gas Company

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
4.7	3.7	1.0	3.3	3.0	2.0	Not used	Not used	1.7

Table 11: Time taken for evaluating criteria – Parabita

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
4.7	3.7	1.0	2.7	2.7	1.7	Not used	Not used	1.7

Table 12: Time taken for evaluating criteria - ETHER Applications Ltd

QC1	QC2	QC3	QC4	QC5	QC6	QC7	QC8	QC9
5.0	4.0	4.0	4.0	4.0	4.0	Not used	Not used	4.0

5.5 Barriers and success factors for the application of criteria

The main barriers in applying the criteria when implementing the pilot projects were the following:

- Convincing the administration – A significant difficulty for the application of the criteria was that of convincing the administration of the client of the need for the level of commitment and detail required for their implementation. The cost of energy for the clients is often of secondary importance and, therefore, the administration does not wish to spend excessive time on this subject. The specificity of the criteria and the time required to evaluate their conformity is also a considerable barrier.
- Funding – As in all EPC contracts the funding of the project is often the most significant barrier. This is especially the case for projects with low budgets and small profit margins which are of little

interest to the large multi-national ESCOs who have access to funding but have significant overhead costs. On the other hand, small ESCOs with less overhead costs who may be interested in the profit margins involved either do not have access to loans, or, the loans encumber their balance sheet and thus restrict their future activities due to their credit limits. Clients usually are reluctant to invest in EPC and therefore usually seek energy services that are able to fund the project.

- User reactions – Interestingly enough, the users are also often a barrier in the application of the criteria mainly due to their dissatisfaction at the comfort levels attained. The main problem is that, even though the comfort levels as foreseen by the EPC are attained, these are something that the users are not used to (e.g. lower internal lighting levels, lower internal temperatures etc.)
- Supplier and maintenance personnel – The dissatisfaction of the suppliers and maintenance personnel with which the client usually transacts can also be a problem. After the implementation of the project, the suppliers and maintenance personnel realize that they may be in a temporary disfavour with the client due to their past practices which have been highlighted by the project's results. Due to their past relationship and acquaintance with the client, which may also be of several years, they know very well how to smear the pilot project to the client.

The main success factors in applying the criteria when implementing the pilot projects were the following:

- The energy audit – The thorough energy audit elaborated by the energy service company within the scope of the pilot project and based on EN 16247 is a powerful tool for the planning of future activities.
- Performance-based contract – Payment based on performance is a very important success factor for the client.
- Monitoring and Verification of guaranteed energy savings – The monitoring and verification of the guaranteed energy savings based on a recognized methodology (i.e. IPMVP) is probably one of the most significant success factors.
- Good quality of Energy Performance contract – The contract includes all control parameters and procedures that ensure the fulfillment of the quality criteria.

In all the implemented pilot projects QC1 – 6 and 9 were used. All of these were included in the EPC contract. Likewise, in all the pilot projects QC 7 and 8 were not used.

5.6 Lessons learned from consultations and pilot projects

The main lessons learned from the consultations with the clients and the energy service providers that implemented the three (3) pilot projects in Greece were the following:

- The technical criteria developed were deemed by all the interested parties to be very specific and thorough and tackle all the necessary aspects of an Energy Performance Contract. Therefore, they do not recommend any further elaboration or addition of further technical criteria.
- The client's main feedback was that the quality criteria are very technical and it is very difficult for them to analyze them and to be able to evaluate the conformity of the EPC contracts offered them by the energy service providers. They did it for the sake of the pilot projects but they would probably not undertake this task in future projects as they do not have either the time or necessary technical expertise.
- Therefore, in the client's view, it is absolutely necessary that either a certified quality label is developed or that the ESCO registry certifies to them that the registered ESCO's conform to the requirements of the QualitEE technical criteria.
- Concerning quality criteria 7 and 8, all clients found them to be particularly useful and interesting but would probably not demand them in an EPC contract as they would add more complexity without significant added-value.

6 CONCLUSIONS

The general conclusions from the implementation of the pilot projects in Greece are the following:

- The technical criteria developed within the framework of the QualitEE project are very thorough and specific and they **fill the gap of the lack of technical criteria for the evaluation of EPC contracts**. Currently, EPC contracts are evaluated based on their comparison with the two standard EPC contracts (guaranteed savings and shared savings) available on the ESCO registry website www.escoregistry.gr.

- According to all interested parties (i.e. energy service providers, clients and facilitators) **quality criteria 1-6 and 9 should be made mandatory** in any future quality assurance scheme. On the other hand, **quality criteria 7 and 8 should be optional**.

- **A quality assurance scheme** consisting of either a new, quality label or the insertion of the developed technical criteria as prerequisites for the registration of an energy service provider in the national ESCO registry **should be institutionalized** as soon as possible.

- Following the institutionalization of the quality assurance scheme and its successful acceptance by the market players, steps for its **certification by accredited certification bodies** should be made.

- It is important that a **European Standard be developed for the evaluation of EPC contracts**. This will help in the transnational development of energy services within the European Union.