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Practices and opportunities for Energy Performance Contracting in the public sector in EU Member States

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Title: Practices and opportunities for Energy Performance Contracting in the public sector in EU Member States

Abstract
The public sector is one of the key users of energy in Europe. Although, the relative energy consumption of the public sector is rather small, i.e. "only" about 5-10% of the total energy demand of European Member States, with an annual energy bill €47 billion (Borg & Co. et al. 2003), there are several reasons to focus on improving the energy performance of public buildings and public installations.

Contents

Executive summary

The public sector is a key energy consumer in Europe. Buildings owned and/or managed by the public sector make up more than 10% of the overall EU building stock. In absolute terms, public buildings and associated installations represent a significant, largely untapped potential for energy savings. Very often public buildings also need maintenance, refurbishment and have a low efficiency. In spite of the potential, public sector proceeds slowly in improving energy efficiency due to a number of barriers, including limited financial resources and/or limited creditworthiness, limited human resources in numbers and in profession, split incentives, etc. Yet, the sector is an excellent target for Energy Performance Contracting (EPC), because EPC pulls in private funds for financing a public project, while it may be a cheaper solution than in-house project management potentially resulting in a complex renovation package. EPC it involves the transfer of technical and often financial risk, offering a professional project management service, due to which the in-house maintenance is able to focus on core activities.

The Joint Research Centre (JRC) has been regularly reviewing the market status and development of Energy Services Companies (ESCOs), including EPC, across the EU Member States since 2005. The current report is unique because it is an exploration of specifically the EPC markets in the public sector during the period 2014-2016. It is also unique in combining surveying and quality analysis tools with a modelling exercise to determine the EPC market potentials.

The picture of the current status of using EPC in the public sector is very diverse. There are only a few countries, where a well-developed EPC market could be identified in the public sector (DK, DE, UK), and several which are well advanced (FI, CZ, NL). France is special case, with a moderately advanced EPC market in the public sector, because the EPC definition actually misses the core EPC value, i.e. repayment from the savings, as a result of the French legislation.

To complement the market review, we estimated the potential energy savings and investment cost needs. The economic final energy demand savings potentials are around 34 and 58,5 TWh in the public buildings of EU Member States, in buildings larger than 1000 and 500 m^2 respectively, with economic savings of a total of 2,7 - 5 Billions of Euro; that would mean a need for total investments of 21,3 - 39,4 Billions of Euro is needed. This total amount can be translated in an average renovation cost per building of about 27 000 € and an average cost per square meter of around 17,5 €/m^2.

We also explored the outlook for the EPC market in the public sector through the survey. Most of the markets are expected to grow in the near future, even those that are still in a preliminary phase. This may be overly optimistic though, especially considering that some of the barriers identified (in particular the ESA 2010 definition) are a major bottleneck (in RO, SK, SI, CZ, SE, ES, PT, PL, etc.

1 Introduction

1.1 Rationale

Energy efficiency is one of the most important pillars of a sustainable energy policy. Regarded as one of the energy resources with the biggest impact, it can address the growing demand for energy, climate change, energy insecurity, import dependency, low competitiveness and rising energy costs. While investments in energy efficiency at first glance seem cost effective, they are not always undertaken due to a number of regulatory and non-regulatory barriers, leading to the so-called energy efficiency gap between actual and optimal energy use (Jaffe and Stavins 1994).

The public sector is one of the key users of energy in Europe. Although, the relative energy consumption of the public sector is rather small, i.e. "only" about 5-10% of the total energy demand of European Member States, with an annual energy bill €47 billion (Borg & Co. et al. 2003), there are several reasons to focus on improving the energy performance of public buildings and public installations.

1) In absolute terms, public buildings and associated installations represent a huge, largely untapped potential for energy savings. Buildings owned and/or managed by the public sector make up more than 10% of the overall EU building stock.

2) The turnover of building technologies is very slow (20-40 years), therefore it is utmost important to renovate in time and in an appropriate depth. The current average building energy renovation rate in the EU is below 1%[1].

3) Other public installations, e.g. streetlighting is also significant. There are more than 56 million street lighting luminaires in operation, with an estimated electricity consumption of 35 TWh/year. For municipalities with older, inefficient systems, street lighting can account for 30-50% of their total electricity consumption, with large saving potentials: with current technologies 30-70% energy savings are generally possible[2].

1.2 Terms and definitions

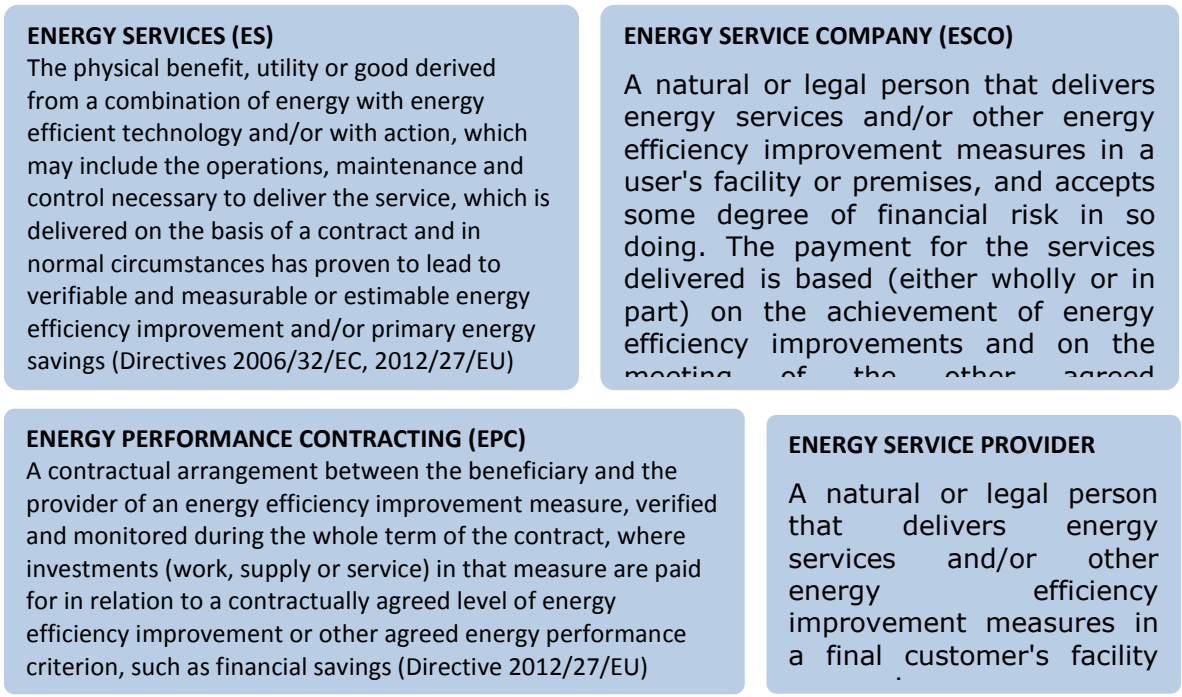
Despite a long history in Europe dating back to the 19th century, the energy services market is still characterised by definitional confusion, which is mainly attributed to the complexity of the offerings, the traditional use of terms in certain countries, the diversity of players in the market, and the current interest of the situation where the terms are used.

Differences in the interpretation of what is entailed by Energy Services Company (ESCO) still exist among experts and stakeholders in the field. The Energy Services Directive (2006/32/EC) describes an ESCO as natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. It stresses that the payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria. The Energy Efficiency Directive (2012/27/EU), on the other hand, does not provide a definition of ESCOs but instead refers to the general term of energy service providers, which includes any natural or legal persons delivering energy services and/or other energy efficiency improvement measures in a final customer's facility or premises (see Figure 1).

[1] http://www.buildup.eu/en/news/overview-exemplary-role-public-buildings-under-energy-efficiency-directive-eed

[2] http://www.streetlight-epc.eu/the-project/

Figure 1 – Key definitions in EU legislations



Definitional varieties also exist at national level, even though the transposition of the EED has converged much of the usage. Nevertheless, occasionally, national definitions are more appropriate in the national context, or local circumstances make it necessary to diverge from the common definition, e.g. because of previous bad experience and thus bad reputation of ESCOs.

1.2.1 Energy services and energy efficiency services

A wide range of activities fall under the umbrella term 'energy services' (Bertoldi, Rezessy, and Vine (2006)) describe energy services as various activities including energy audits, energy management, project design and implementation, maintenance and operation, monitoring and evaluation of savings, and energy and equipment supply. Along the same lines, the definitions provided in the Directives 2006/32/EC and 2012/27/EU point to various services delivered on the basis of a contract, which in normal circumstances have proven to lead to verifiable and measurable or estimable energy efficiency improvement and/or primary energy savings.

While the terms energy services and energy efficiency services are mostly used interchangeably, a distinction can be made to highlight the specific focus on energy efficiency of the latter. According to standard EN15900, energy efficiency services are defined as an agreed task or set of tasks designed to lead to an energy efficiency improvement and other agreed performance criteria. An energy efficiency service shall:

- be designed to achieve an energy efficiency improvement and meet other agreed performance criteria, such as comfort level, production throughput, safety, etc.;
- be based on collected data related to energy consumption;
- include an energy audit as well as identification, selection and implementation of actions and verification.

1.2.2 Energy service providers/suppliers

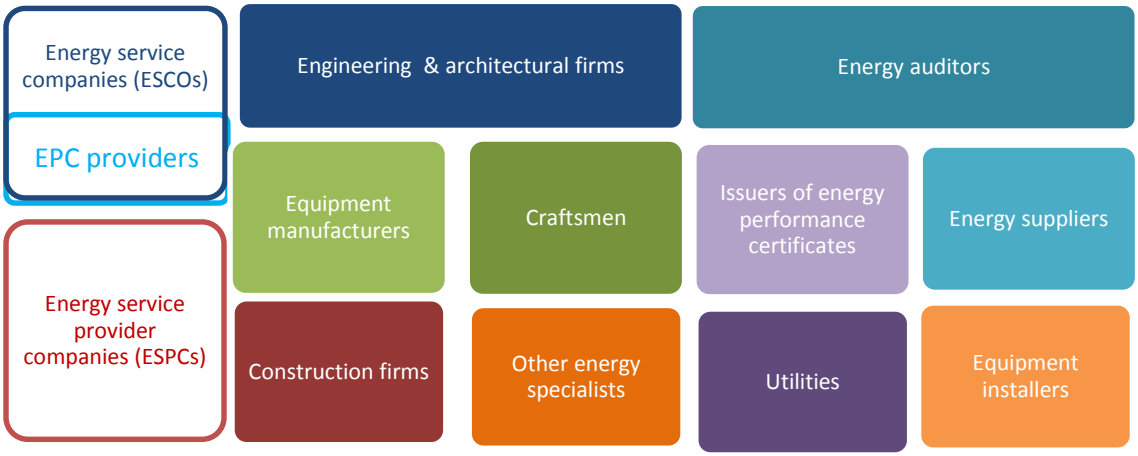
Energy service providers/suppliers may refer to all natural or legal persons who deliver energy services or other energy efficiency improvement measures in a final customer's facility or premises. They are commonly called ESCOs and the distinction is not well developed. The market is made up of various energy service suppliers, ranging from energy specialists, auditors, consultants, engineering and architectural firms to trades people and craftsmen. The EED's definition of energy service providers points to this broad umbrella term, which includes anyone delivering energy services and/or other energy efficiency improvement measures. This definition includes companies that do not assume performance risk for their projects but excludes companies that only engage in the design and installation of on-site generation or renewable energy systems without the deployment of energy-efficiency measures.

Energy Service Companies (ESCOs) hold a distinct role in the field of energy services providers. They are a key player in the supplier chain as they can provide turnkey services covering a full range of activities: energy audit, design engineering, construction management, arrangement of long-term project financing, commissioning, operations and maintenance, savings monitoring and verification. Their distinct feature is associated with their remuneration structure, and in particular, their performance-based projects (i.e. energy performance contracts, see section 1.2.3).

There are variations in the ways ESCOs operate; the key differences being the type of contract and financing sources.

The ESCO companies that carry out EPC contracts are more and more commonly referred to as EPC providers, in order to distinguish them from those ESCOs that do not use a performance guarantee. In this meaning EPC providers are a type of ESCOs that offer a savings guarantee and link their remuneration to the achievement of the contractually set savings target. In the current report, the terms ESCO vs. EPC providers are used accordingly.

Figure 2 – The diverse landscape of energy service suppliers/providers



On the other hand, energy service provider companies (ESPC) provide energy services for a fixed fee or as added value to the supply of equipment or energy (such as heating) (Pätäri and Sinkkonen 2014). They operate on a design and build principle and their compensation is based on a predefined fee. All companies such as energy auditors, issuers of energy performance certificates or engineering firms that do not assume performance risk fall under this term.

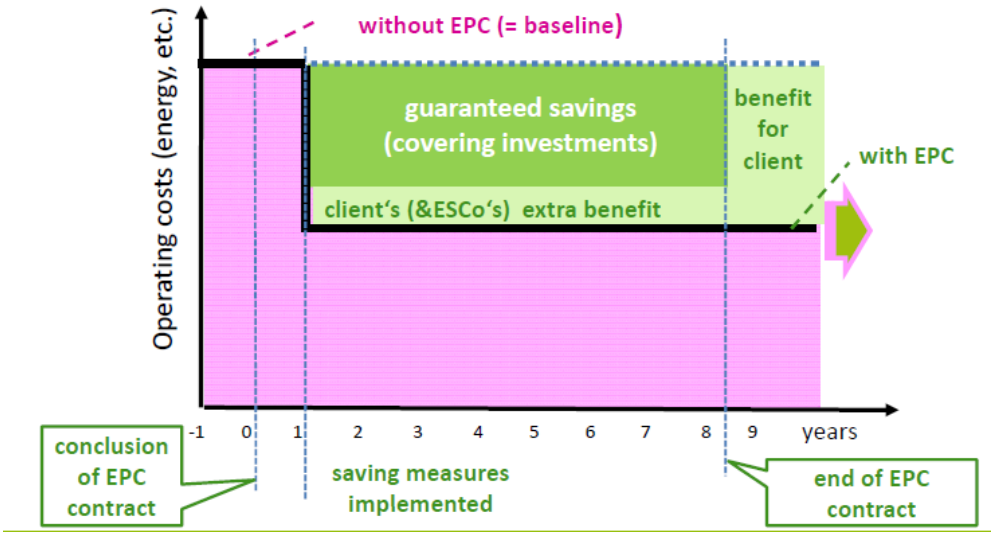
1.2.3 Energy service contracting

An energy service contract describes a contractual relationship between an energy service supplier/provider and the final energy user (client). These can be classified in the following groups:

1.1.1.1 a) Energy Performance Contracting

Under an energy performance contract, an ESCO undertakes a project to deliver energy efficiency improvements in the premises of the client, and uses the stream of income from the cost savings to repay the costs of the project. The approach is based on the transfer of technical risks from the client to the ESCO based on performance guarantees given by the ESCO. The savings that are achieved are used to partly or fully pay for the investments that were made. After the end of the contract, the cost benefits brought about by the energy savings remain with the customer (Bertoldi, Rezessy, Vine 2006). Figure 3 shows the basic arrangement of an EPC project.

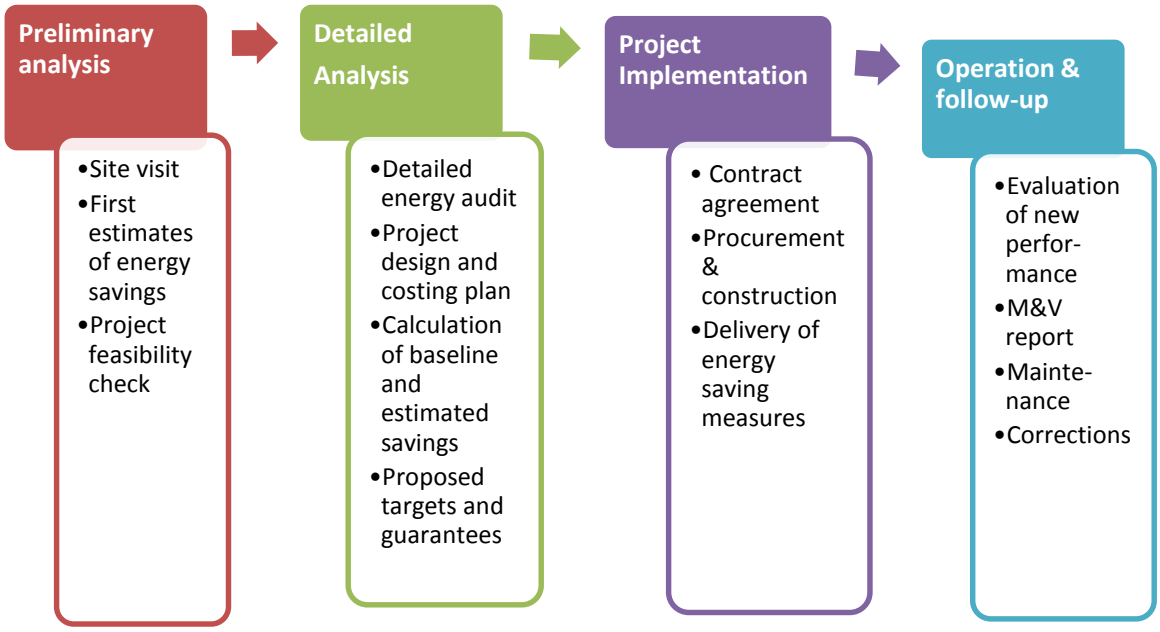
Figure 3 - The timeline and the savings expected in an Energy Performance Contracting scheme.



Source: (Szomolanyiova & Sochor, 2013)

Once the installation of the energy efficiency measures is complete, the project moves to evaluation of new performance phase. The specific nature of service provided will depend upon the contract. Energy savings are a key benefit that should be achieved as the EPC service is paid by realized energy cost savings. The contract between the ESCO and client contains guarantees for cost savings and takes over financial and technical risks of implementation and operation for the entire project duration of typically 5 to 15 years.

Figure 4 - Phases of a project under the EPC model



There are two types of EPC-based projects. Under a guaranteed savings EPC-based project, the ESCO designs and implements the project and guarantees the energy savings, thus shielding the client from any performance risk (including technical and implementation risks). If the savings are less than the guaranteed level, the ESCO covers the shortfall. If the savings exceed the guaranteed level, the additional savings are shared between the ESCO and client. Conversely, under a shared savings EPC-based project, the savings are split in accordance with a pre-arranged percentage: there is no 'standard' split as this depends on the cost of the project, the length of the contract and the risks taken by the ESCO and the consumer (Bertoldi, Rezessy, Vine 2006). The differences between the two approaches relate also to the payment arrangements, the primary technical focus, and the allocation and apportionment of energy savings. These are illustrated in Table 1.

1.1.1.2 b) Energy Supply Contracting

The subject of this contract type is the supply of energy, typically in the form of heat, whereby the ESCO undertakes installation works and supplies energy to the client. The focus of energy supply contracting is the reduction of supply costs rather than demand-side efficiency gains, with energy efficiency measures being typically limited to the energy supply and transformation side. These measures include the optimisation of the equipment (e.g. purchase of heat produced by a biomass boiler), production of electricity from cogeneration plants, etc. The energy supply contracts require longer terms (10-30 years) and are best suited for centralised systems such as heating and cooling. Once the ESCO completes the installation, it is paid for the quantity of energy supplied over the term of the contract. In France, this is also known as "chauffage" model which has been in use for more than 60 years. Under this type of contract, the costs of all equipment upgrades, repairs etc. are borne by the ESCO, while ownership typically remains with the customer. The customer pays a fee which is based on its existing energy bill minus a percentage savings (often in the range of 3-10%) or a fee based on the conditioned floor space (Singh et al. 2009).

Table 1 - Key characteristics of EPCs and ESCs compared

	EPC - Guaranteed savings model	EPC - Shared Savings model	Energy Supply Contracting (ESC)
Service provider	ESCO/EPC provider	ESCO	Energy Supply Provider Company (ESPC)
Key elements	Implementation of energy saving measures with on-going monitoring & verification services to provide guaranteed energy savings.	Implementation of energy saving measures (mainly demand side) to provide cost savings associated with the overall energy/utility bill.	Efficient supply of useful energy such as heat, steam or electricity is contracted, measured and delivered in physical units.
Energy savings to be achieved	High - comprehensive and detailed approach covering both supply and demand side.	High - primary focus and incentive is for cost savings with technical operation requirements as secondary.	Usually low - limited to the supply side (boilers, chillers, etc.) without regard to demand- side equipment.
Guarantees	Yes. The ESCO guarantees the performance related to the level of energy saved throughout the contract life (i.e. to energy cost savings in constant prices).	Not as standard. However, the ESCO may guarantee a minimum performance related to cost of energy saved in current prices throughout the contract life.	May include incentives related to energy use reduction on the supply side, but without assuming any risk in case the expected efficiency improvement is not reached.
Payment	Payment derived from the energy savings achieved in constant prices of the base year.	Payment linked to the achieved change in energy costs.	Payment of a fixed rate/tariff, normally without energy performance requirements.
Provider's risk	Assumes technical design, implementation and performance guarantee risks.	Assumes performance risk, risk of energy price change (depends on current prices) and customer credit risk.	Usually does not assume technical or financial risk.
Energy savings transparency	The energy consumption is measured before and after the measures are implemented. The transparency depends	Depends whether and what quality M&V is provided. In general, the more independent M&V, the more	Low - a specific energy bill reduction is established (in monetary, not physical units). Usually the contract

	EPC - Guaranteed savings model	EPC - Shared Savings model	Energy Supply Contracting (ESC)
	on the quality of measurement & verification. In general the more independent M&V, the more transparent are the energy savings.	transparent are the energy savings.	does not take into account the measurement of the energy efficiency.

The focus of the current report is on Energy Performance Contracting, EPC. The term EPC provider will be applied to the ESCOs dealing with EPC, and therefore herein the term "ESCO" shall refer to EPC providers only.

1.3 Benefits of EPC in the public sector

Based on the above, the public sector is an excellent potential client of Energy Performance Contracting.

From the **Beneficiary (public administrator or client)** point of view an EPC project offers the following opportunities:	From the **Contractor (EPC provider)** point of view:
• involvement of private funds for a public project, which is excellent especially if the public body is limited in budget; • can be a cheaper solution (but not always!) than in-house project management; • transfer of technical and often financial risk; • receiving complex renovation package (if wanted); • no need for sophisticated in-house expertise; • project management overtaken, thus ability to focus on core activities; • possibility to get involved in more projects (liquidity issues resolved).	• long term projects possible (usually); • reliable partner, including payment (usually); • large projects, often pooled; • dissipation effect (among public sector bodies and to the private building owners); • baseline available (usually).

1.4 Exemplary role of the public sector and its impact on the EPC market

EPC projects in the public sector can and should be **shown as example** to the wider public and further potential clients, which serves as a good case study for people getting in contact with the public body and/or those who visit the building being renovated via EPC.

The renovation of existing public buildings is dealt with in Article 5 of the **Energy Efficiency Directive** (EED, Directive 2012/27/EU). According to Art. 5 of the directive the public sector must lead by example by renovating 3% of buildings owned and occupied by the central governments starting from 01 January 2014 and by including energy efficiency considerations in public procurement – insofar as certain conditions are met (e.g. cost-effectiveness, economic feasibility) – so as to purchase energy efficient buildings, products and services. It also stresses that governments shall undertake an exemplary role in the energy retrofit of their countries' building stock.

The recast **Energy Performance of Buildings Directive** (EPBD, Directive 2010/31/EU) introduces or strengthens a number of measures related to the energy performance of new and existing buildings. Of particular relevance for public authorities is the requirement set out in Art. 9 of the EPBD which requires Member States to ensure that

"after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings".

The recast **Energy Labelling Directive** states that, in concluding public contracts, public authorities "shall endeavour to procure only such products which comply with the criteria of having the highest performance levels and belonging to the highest energy efficiency class." Member States are also empowered to set minimum criteria for the procurement of energy-related products.

The **Ecodesign Directive** is of specific relevance to the development and application of technical or performance-based specifications by public authorities in their procurement. It is relevant for EPC that the Directive applies not only to energy-consuming products but also to those which have an impact on energy consumption during use, for example windows and insulation material.

Public buildings are expected to fulfil an exemplary role also under the **Renewable Directive** (2009/28/EC) whereas Member States may establish specific standards for the inclusion of renewable energy sources in public or mixed public-private buildings.

Besides the exemplary role of the public sector, public sector EPC projects usually collect a pool of buildings and/or affect large scale renovation of e.g. public lighting, due to which an **economies of scale** effect is introduced, pulling down the prices of the project. Besides the price benefits, the wide scale local impact of energy performance improvement is excellent.

Finally, public EPC projects can **boost the demand side** of the EPC market. If the number of orders (contracts) increases because the public body implements several projects or because other public bodies learn from them, the public sector has the potential to actually develop a market demand. By developing the demand side of the EPC market, suppliers will be quick in catching up with offers, developing new models, and the whole EPC market can start to flourish.

1.5 Aim and objectives of the report

As described above, the application of EPC in the public sector is highly beneficial. This is reflected by the number of relevant legal documents at the EU level and at national/local level, as well as the strategic importance given to EPC in many countries, as shown in their NEEAPs and in the SEAPs.

Besides the top-down pressure to widen the ESCO market around Europe, the market has been developing at a reasonable rate on its own, too.

It has been shown that the interest and thus the application of EPC have been growing in several Member States (Boza-Kiss et al. 2017). Nevertheless, the results concluded from the literature and reports available to the authors is largely robust, and a more specific understanding of sector level activity is not properly mapped. Such a gap of knowledge limits the impact of general measures for the ESCO market, because they might not be appropriately targeted, or they miss to overcome key barriers. Also, in selecting measures for the improvement of public sector energy performance, the opportunity offered by EPC might be overlooked, due to the unawareness of available policy measures and their potential impact.

To overcome this gap of knowledge, **the current report offers two key analyses**.

A) On the one hand, the authors have developed a **model** providing a preliminary estimation of the overall **market potential of EPC** in the EU public sector. It is based on the last data available (i.e. on the first version of the Building Stock Observatory of the EC) and several assumptions to fill the gaps. Hence it provides an assessment of: i) the size and composition of the national stocks of public building; ii) the energy saving potential related to measures which can be covered by EPC schemes; iii) the connected economic savings and investments needed to obtain the default energy saving rate and payback time.

B) Secondly, the report maps the **status of EPC market in the public sector** of all EU Member States and identifies successful examples, as well as maps key barriers, specific for the public sector. An overview on the EU level is also provided.

To this end, a field research was combined with document and desk research. National documents and reports were consulted. There have been a good number of relevant H2020 projects in the period of 2014-2016, whose findings proved useful to compare to the results of the survey and clarify possible differences.

A targeted questionnaire, focused on EPC was prepared and distributed among national experts. Contacts were used from the JRC's ESCO network, and new contacts were also identified using a snow-ball technique. The survey was sent out to around 300-400 contacts between May and June 2016, at least 5-10 contact points per Member State, and the responses were collected electronically. Occasional phone interviews were used to supplement the information. Responses were received from around 80 survey participants.

1.5.1 Limitations and focus

The focus of the current report is on the Energy Performance Contracting market (in a narrow sense, i.e. with guarantees provided and risks shared) in the public sector.

The information in the report should be read with some limitations in mind. The information is from 2015-2016, and the markets are quickly changing, therefore the description of the status of the market can be sometimes already outdated. Nevertheless, this is probably a minor problem, because the trends were also drawn in the MS reports.

Comparison of data between Member States should be dealt with care, because data are robust and terminology in one Member State (MS) may have slightly different meaning in another. While definitions are clearer today, and we find that it is significantly easier to communicate requests about numbers and sizes than 10 years ago, there are still major differences in the local understanding of the same concept. With this in mind, the report does provide a few comparative tables, but the values should be compared only to get an overview.

There were a few countries where information was not possible to collect. These problems are indicated at the MS chapters.

2 EPC market potential in the public sector

2.1 The characterisation of the public building stock in EU

Because official statistics are not available, several assumptions are needed to provide a preliminary picture of the European stock of public buildings.

As main starting point we have considered the figures collected from the first version of the Building Stock Observatory (BSO) of the European Commission. In particular, selecting 2013 as reference year, and also taking into account the following indicators:

- Number [thousand] of: offices, private offices, public offices, wholesale and retail trade buildings, hotels and restaurants, health care buildings and educational buildings. This data is generally available for all Member States, but as estimation based on surface data and ratio from neighbouring country.
- Total floor area [Mm^2] of: offices, private offices, wholesale and retail trade buildings, hotels and restaurants, health care buildings, educational buildings, sport facilities and other non-residential buildings. With the exception of the two last categories, estimation for this data is generally available for all Member States.
- Energy consumption [Mtoe] of: private offices, public offices, wholesale and retail trade buildings, hotels and restaurants, health care buildings, educational buildings, sport facilities and other non-residential buildings. Estimations are available only for few Countries included in the ODYSSEE database (i.e. Estonia, France, Germany, Malta, Romania, Spain, Sweden, UK).
- Final energy consumption [Mtoe] of (all) non-residential buildings for: space heating, space cooling, water heating, lighting and total. This data is available for all Member States, since they are included in the EUROSTAT and JRC-IDEES databases.

While for offices the distinction between private and public is available, the other public buildings are not disaggregated according to these categories. To overcome this missing information complementary parameters and assumptions have been used:

- the number and total floor area of public health care buildings were estimated considering the percentage of public health expenditure (on the total health expenditure) included in the World Health Organization Global Health Expenditure database.
- the number and total floor area of public educational buildings were derived from the percentage of enrolment in primary and secondary education in private institutions provided by the UNESCO Institute for Statistics.
- the number and total floor area of other public buildings (e.g. sport centres, museums, prisons, barracks, etc.) have been estimated simply as the 25% of other non-residential buildings.

In this way the shares of non-residential floor area owned or occupied by public entities (Figure 5), and consequently the squared meters (Figure 6), have been obtained for all Member States.

Figure 5 – Share of public floor area (per building type) on the total floor area of non-residential buildings

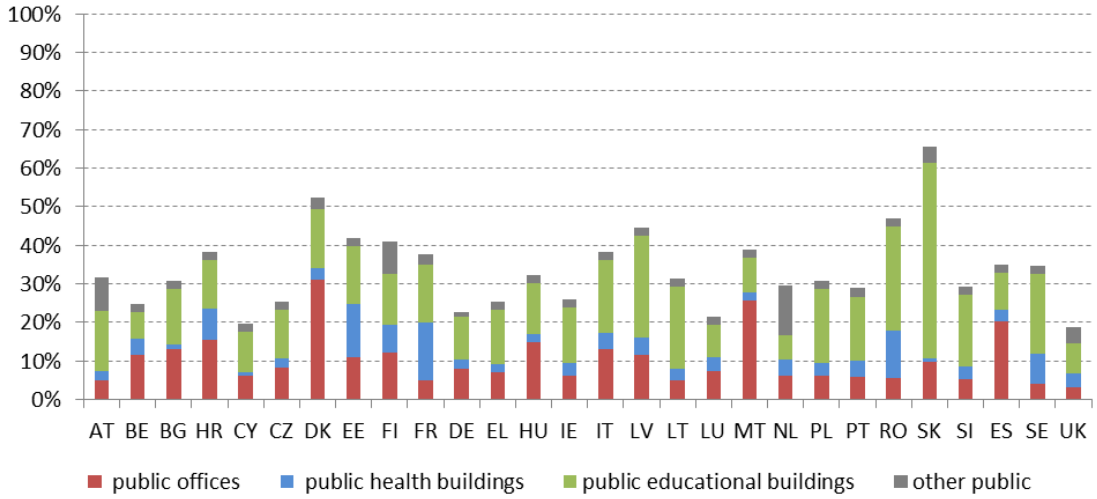
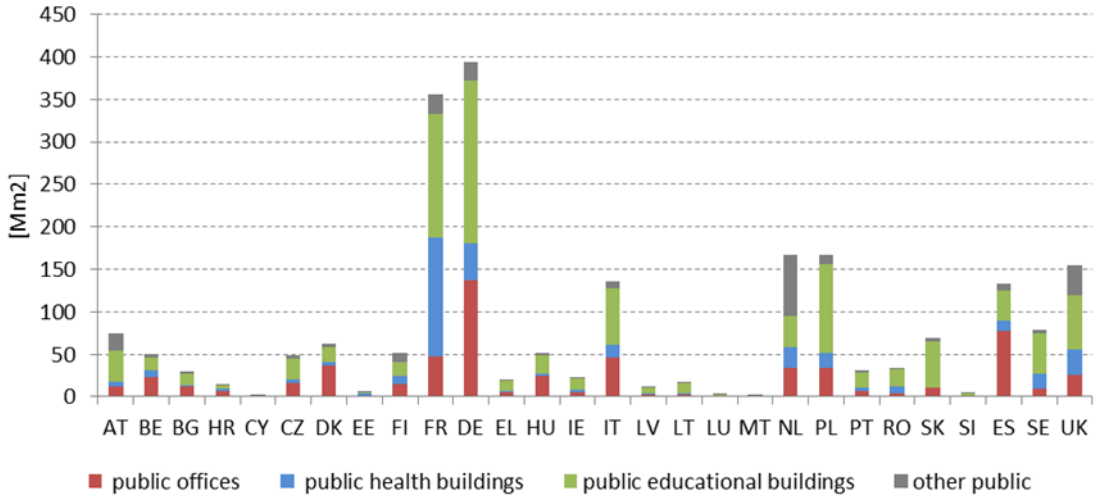


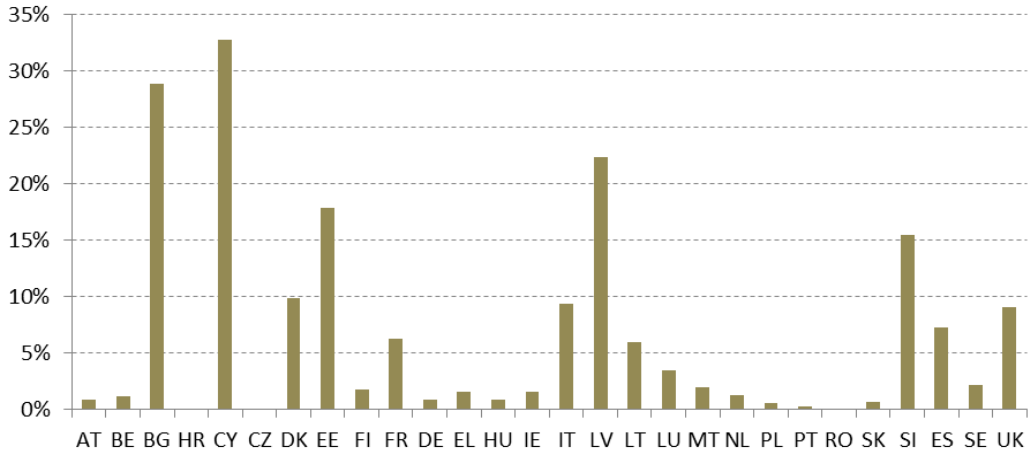
Figure 6 – Floor area of public buildings (per type) in the EU Member States.



It is interesting to compare the floor areas obtained here with those collected under the Article 5 of EED. In accordance with this requirement Member States were required to publish an inventory of central government buildings by 31 December 2013 (Article 5(5)), containing data on the floor area and energy performance of each building and report annually (Annex XIV Part 1) on the remaining total building floor area which did not meet the energy performance requirements.

The graph below shows the ratio between: i) the floor area owned and occupied by central government buildings larger than 250 m^2 (as communicated by Member States) and ii) the total floor area of public buildings (as obtained above). In total we count more than 90 Millions of m^2 owned/occupied by central government buildings and in average they represent the 4% of total public buildings. Higher percentages can be observed in some small Countries (CY, BG, LV, SI, EE), while very low values are attributable to federal Countries (e.g. AT, BE, DE).

Figure 7 – Percentage of the floor area owned and occupied by central government buildings (larger than 250 m^2) on the total floor area of public buildings (data non available for HR, CZ and RO)



The building numbers (Figure 8) and the average floor areas (Figure 9) of the considered public building types were derived using the available data and introducing the assumption that the average floor area of "other public" buildings is equal to the mean of the average floor area of other public types.

Figure 8 – Number of public buildings (per type) in the EU Member States

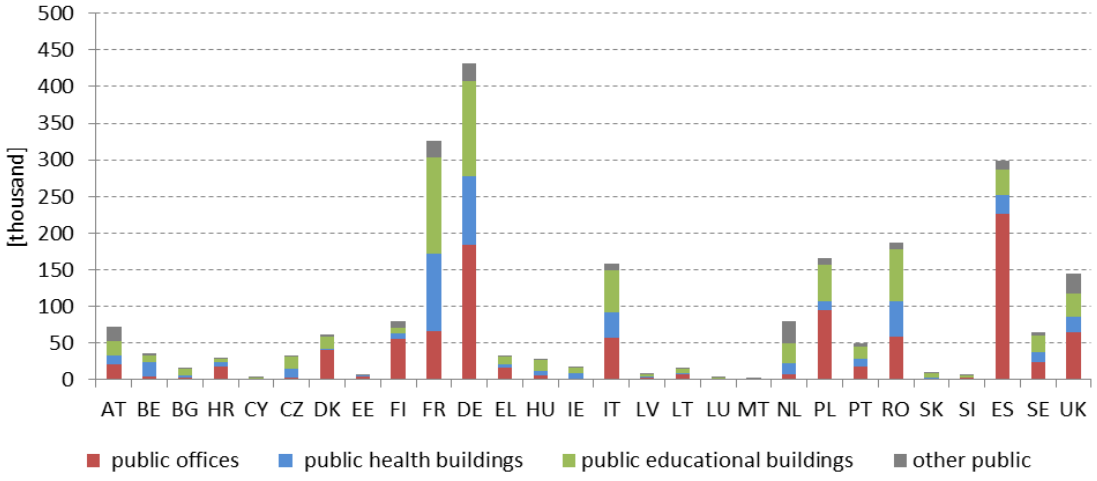


Figure 9 – Average floor area of the public buildings (per type) in the EU Member States.

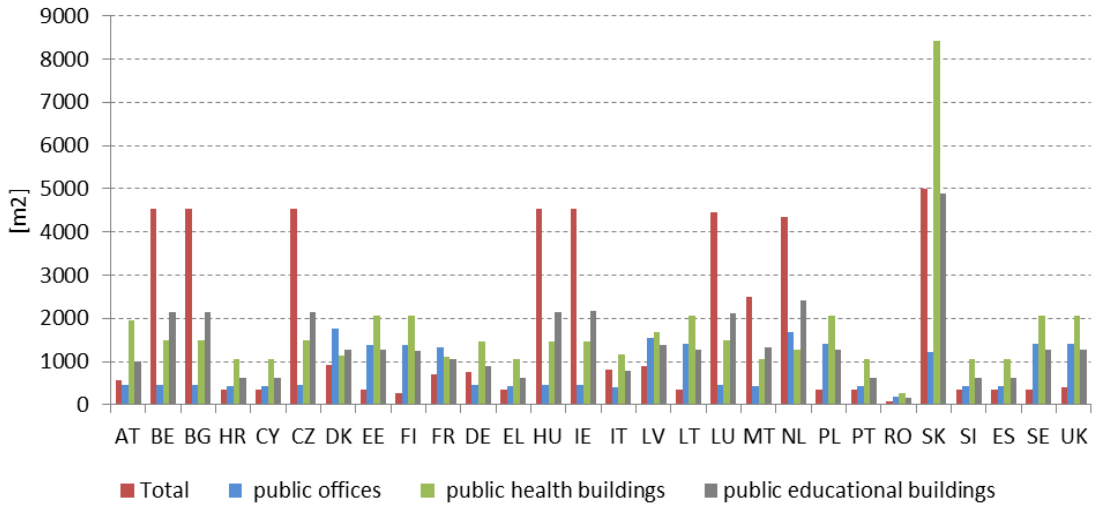
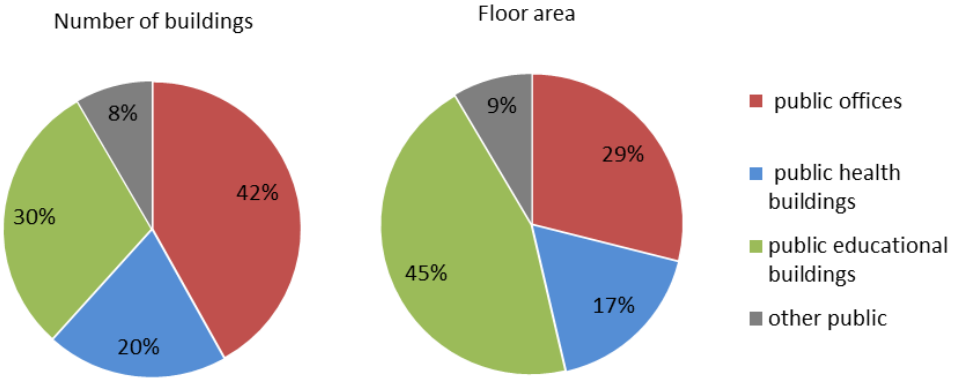


Figure 10 – Shares of public building types in the EU.

At European level we estimated a total of 2,37 Millions of public buildings, with a total floor area of 2025 Millions of m^2. As shown in Figure 10, they are mostly offices and schools: together these categories represent the 72% of buildings and the 74% of the public floor area. On average the European school has a size of almost 1300 m^2, the office of about 600 m^2, while for the mean health care building the area is of about 850 m^2.



Because generally the ESCOs focus on relevant renovation projects, it is interesting to estimate also how many are the buildings with a significant size. Assuming a normal distribution around the mean values (with a standard deviation expressed as a function of the same average floor areas), we obtained almost 1,5 Million of EU public buildings larger than 500 m^2 (with a total floor area of 1811 Millions of m^2) and almost 850 thousand larger than 1000 m^2 (pair to a total floor area of 1313 Millions of m^2).

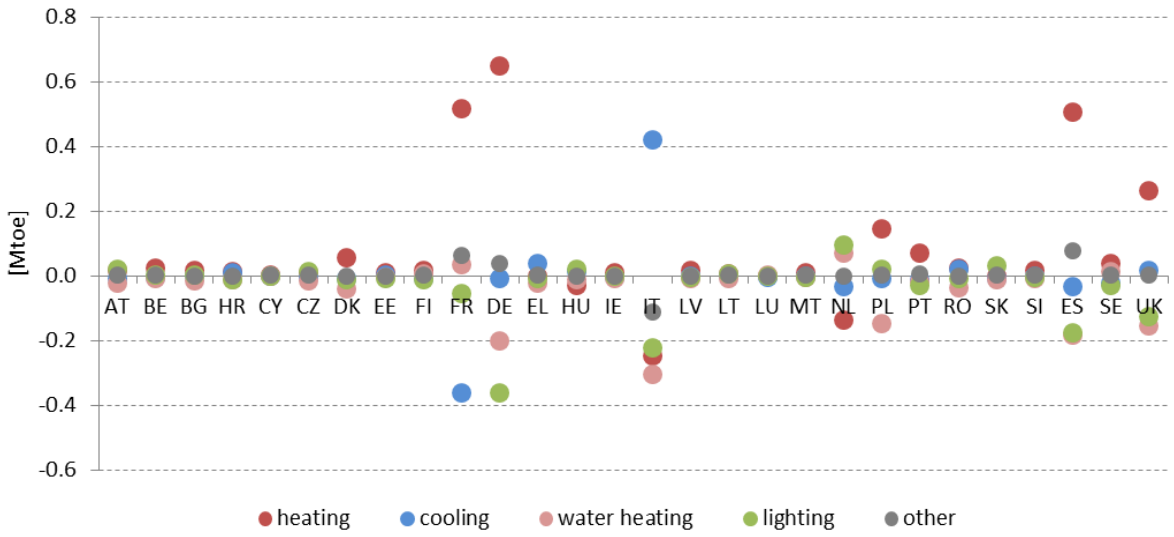
To quantify the related energy consumptions (for space heating, space cooling, water heating, lighting and other uses) we adopted a two-steps method, in particular: i) a

bottom-up approach based on the energy consumptions of typical building types, ii) calibrated on the total energy consumptions available from the BSO (see above). As reference for the first step the database provided by the ENTRANZE project[3] have been used. It includes final and primary energy consumptions associate with main end-uses for typical offices and schools located in 10 representative EU climates, as results of dynamic simulations of building models. Starting from these references we estimated by analogy the missing data relative to the Countries and building types not covered by ENTRANZE.

In the second step the obtained values have been opportunely multiplied by corrective coefficients in order to calibrate the resulting total energy demand on the national consumptions attributable to public buildings. These last have been calculated multiplying the values for all non-residential buildings per the total shares of public floor area shown in Figure 5.

After the calibration we obtained an overestimation of 0,13 Mtoe at EU level, pair to the 0,3% of total final energy consumptions attributable to public buildings (43,0 Mtoe). The differences for each Member States are shown below (Figure 11).

Figure 11 – Calibration results: absolute differences between the total energy consumptions estimated in bottom-up way for all public buildings and those attributable to public buildings from national statistics.



As final results of this calculation we obtained the calibrated typical final energy consumptions per building type and end-use (Table 2), as well the total energy consumptions associated to the larger buildings in all EU Countries (Figure 12).

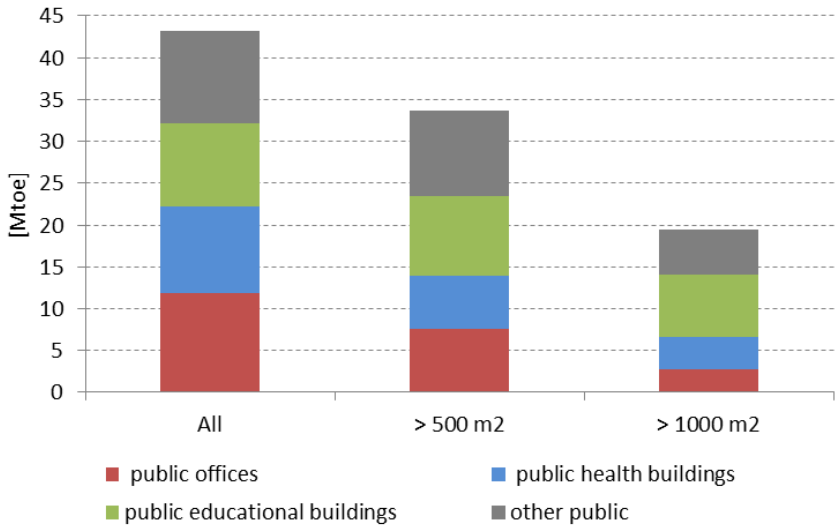
[3] http://www.entranze.eu/pub/pub-optimality

Table 2 - Typical final energy consumption [kWh/m^2 year] per end-use ("H": heating; "C": cooling; "WH": water heating; "L": lighting) and public building type in the EU Member States.

MS	public offices				public health buildings				public educational buildings				other public			
	H	C	WH	L	H	C	WH	L	H	C	WH	L	H	C	WH	L
AT	80	3	2	15	100	3	40	15	82	0	5	15	87	1	9	15
BE	187	7	3	16	233	7	46	20	164	0	10	15	193	3	15	15
BG	46	3	2	15	57	5	40	20	48	2	5	15	51	3	10	15
HR	79	18	4	15	100	21	43	15	68	11	11	15	82	18	15	15
CY	85	57	7	28	106	71	78	15	71	28	15	28	85	50	15	28
CZ	115	2	2	15	143	2	40	20	106	0	7	15	121	2	13	15
DK	116	2	2	15	145	2	40	20	100	0	7	15	120	2	14	15
EE	226	4	8	20	282	4	59	20	194	0	12	20	234	4	15	20
FI	171	0	6	15	212	0	45	20	147	0	9	15	177	0	15	15
FR	134	7	2	15	166	9	40	20	117	0	7	15	138	5	14	15
DE	130	5	3	15	163	5	40	20	112	0	8	15	135	3	15	15
EL	94	63	8	30	117	78	80	15	78	31	15	30	94	55	15	30
HU	94	7	3	17	117	10	47	20	97	3	10	15	104	7	15	15
IE	93	2	2	15	115	2	40	20	81	0	5	15	96	2	10	15
IT	236	86	11	30	300	107	80	15	204	32	15	30	247	75	15	30
LV	183	0	6	16	228	0	48	20	158	0	10	16	190	0	15	16
LT	65	1	2	15	82	1	40	20	56	0	5	15	68	1	8	15
LU	203	7	4	18	253	7	50	20	178	0	11	15	210	4	15	15
MT	95	63	8	30	119	79	80	15	79	32	15	30	95	55	15	30
NL	88	2	2	15	109	2	40	20	77	0	5	15	91	2	9	15
PL	100	2	2	15	125	2	40	20	86	0	6	15	104	2	12	15
PT	86	14	3	15	108	17	40	20	75	6	8	15	88	11	15	15
RO	132	14	5	24	165	19	66	20	137	5	14	19	146	14	15	19
SK	124	4	2	15	154	4	40	20	126	0	7	15	135	2	13	15

SI	159	3	3	15	199	3	40	20	162	0	9	15	173	3	15	15
ES	123	24	4	16	155	32	48	20	107	8	12	16	127	20	15	16
SE	119	0	4	15	148	0	40	20	102	0	6	15	123	0	15	15
UK	111	9	2	15	148	12	40	20	81	2	7	15	113	7	14	15
EU	**124**	**15**	**4**	**18**	**155**	**18**	**49**	**19**	**110**	**6**	**9**	**17**	**130**	**12**	**14**	**17**

Figure 12 – Total final energy consumptions associated to all EU public buildings and to those larger than 500 m^2 and 1000 m^2



2.2 About the estimation of the energy saving potential and ESCO market

As a first approximation, we consider that a typical renovation of a public building might mainly concerns the lighting and thermal systems. LED lamps, electronic ballasts, presence sensors, Building Energy Management Systems (BEMS), and efficient heating/cooling generators are probably the most interesting technologies on which an ESCO would develop a business plan as first step.

As average European references, we estimate that:

these kind of renovation measures are applicable to the 60% of existing public buildings;

a right mix of these technology (in function of the building type and main end-uses) can lead to an average energy saving rate (r) of 25%;

their maximum simple payback period is 8 years.

Starting from these assumptions it is possible to calculate the investment costs associated to these renovation measures in a reverse way. In fact they can be simply obtained multiplying the annual economic savings (s) per the payback period, as follows:

$$s = r \cdot \left(FEC_H \cdot \left(p_{el} \cdot H_{el} + p_f \cdot (1 - H_{el}) \right) + FEC_{other} \cdot p_{el} \right)$$

Where: r is the energy saving rate; FEC_H is the final energy consumption for space heating and FEC_{other} that one for the other end-uses; p_{el} and p_f are the prices for electricity and fossil fuels; H_{el} is the percentage of buildings heated by electric systems.

We solve the calculation using the last energy prices available in the EUROSTAT database (for the first semester 2016) and approximating H_{el} as the ratio between the consumptions for heating of electric systems and the total heating consumption in the residential sector of each Member State.

Finally we estimated that:

— 34 and 58,5 TWh can be saved in the EU public buildings respectively larger than 1000 and 500m^2;

— economic savings of 2.7 - 5 Billions of Euro at European level are associated to these energy savings;

— to achieve this, a total investment of 21.3 – 39.4 Billions of Euro is needed. This total amount can be translated in an average renovation cost per building of about 27 000 € and an average cost per square meter of around 17.5 €/m^2.

These figures characterise the potential ESCO market in EU. The results obtained for the Member States are shown in the table below.

Table 3 – Potential ESCO market in the public buildings (per type) larger than 500 m^2 of EU Member States.

MS	Energy savings [GWh]				Economic savings [MEUR]				Investment costs [MEUR]			
	Office	Health	Educ.	Other	Office	Health	Educ.	Other	Office	Health	Educ.	Other
AT	157	59	167	189	12	4	13	14	97	34	100	113
BE	832	164	454	504	45	9	23	26	359	68	187	207
BG	197	42	115	121	16	3	9	10	131	27	75	78
HR	10	50	141	120	1	4	12	10	6	32	92	79
CY	1	5	14	11	0	0	1	1	1	4	10	8
CZ	384	77	218	244	27	5	15	17	213	43	120	135
DK	922	408	389	401	110	47	46	47	879	378	369	375
EE	7	107	108	121	1	8	8	9	4	60	62	69
FI	1	473	477	516	0	29	29	31	0	228	232	249
FR	1370	4134	4225	5001	109	325	329	391	870	2600	2631	3126
DE	4069	1033	2881	2920	416	103	288	290	3327	825	2304	2318
EL	13	60	144	120	1	6	14	12	11	45	115	98
HU	541	92	245	258	33	5	14	15	264	43	115	122
IE	124	36	103	121	10	3	8	10	82	23	68	79
IT	3042	490	1895	1837	320	48	180	187	2561	381	1438	1495
LV	117	82	82	87	8	6	6	6	64	44	45	47
LT	5	44	44	52	0	3	3	4	3	25	26	30
LU	48	12	32	36	3	1	2	2	23	5	15	17
MT	59	14	33	33	7	1	4	4	54	11	29	30
NL	596	551	544	690	34	31	31	39	273	245	249	311
PL	81	656	657	739	5	39	39	44	39	310	316	352
PT	11	62	182	159	1	6	18	16	9	49	146	127
RO	0	0	1	0	0	0	0	0	0	0	0	0
SK	242	79	75	79	14	4	4	4	109	34	32	34
SI	2	11	32	27	0	1	3	2	1	8	23	19

ES	181	696	1856	1454	18	68	177	141	142	540	1415	1128
SE	27	526	531	626	1	24	24	28	10	188	194	224
UK	151	1051	1075	1226	13	86	90	101	103	691	724	809
EU	**13189**	**11015**	**16719**	**17691**	**1204**	**868**	**1391**	**1460**	**9633**	**6944**	**11130**	**11680**

The starting data might be too uncertain and the method adopted might be too simple to catch all peculiarities that distinguish the different Countries (i.e. climatic conditions, market development of EE technologies, occupant behaviour, etc.). For this reason the numbers provided for each Member State should be taken with caution. The orders of magnitude at European level are probably more significant, since the averaging operation combines the under- and over-estimations unavoidably obtained at national level.

3 Overview of market status of EPC in the public sector

The average ESCO market of the European Union has been on a steady rise for the last decades. Even if the financial crisis of 2008 caused a short backdrop, the ESCO markets were able to overcome the challenges, and turn the financial restrictions into an opportunity. As of 2014-2016, in general the markets are on a growth path, although this growth is not as widespread across countries as it was in the period 2010-2013.

Table 4 - Overview of the size of the ESCO markets across Europe.

	number of[4] ESCOs						EPC providers		EPC projects
	first ESCO[5]	2005	2007	2010	2013	2015	before 2016[6]	2016	2016
AT	1995	25	ca. 30	5-14	over 50	41	10-20 (2013)	15-20	25-28/yr.
BE	1990	4	ca. 30	13-15	10-15	10-15	3-5 (2013)	7(-20)	5/yr.
BG	1995	18/12	1-3 (12)	20	7-12 (?)	15	4 (12) (2013)	8-15	4-7/3 yrs.
CR	2003	1	1(-2)	2	10	10	0 (2013)	5	10/3yrs (60 in pipeline)
CY	2016	0	0	0	0	19	0	19	0 (2 in pipeline)
CZ	1993	3	7 (15)	8-10	20	15	5 (2010)	8-10	30-60
DK	ca. 2010	0	4-5	10	15-20	15-20	ca. 15 (2013)	6-8	10-12
EE	1986	20 (?)	2	2	2 (3?)	2-3 (<10)	0?	0?	few
FI	2000	4	9-11	8	5-8	6-8	n/a	5-7	ca. 12/3yrs
FR	1800's /1937	n/a	3 (100)	10+100	350	300	3-4	10	ca. 40
DE	1990-1995	500-1000		250-500	500-550	ca. 500	10 + occasional	7-10	30
GR	ca. 2003	0	0-3	2	5	47	0	1	0-10

[4] In some cases the contradicting values found had to be consolidated based on expert knowledge. If information was available about the registered number (of e.g. ESCOs) vs. the actually active ones, both of these are indicated – with the previous value in parenthesis: ()

[5] based on Vine 2005 and the JRC reports, unless otherwise indicated

[6] date of the information is in ()

	number of[4] ESCOs					EPC providers		EPC projects
	first ESCO[5]	2005	2007	2010	2013	2015	before 2016[6]	2016	2016
HU	1990s	10-20		20-30	10	ca. 8-9	ca. 7	3-4	1-2
IE				15	ca. 30				
IT	early 1980s	20	15-25	50 (100)	50-100	200-300	ca. 20	4-5 (ca. 20)	ca. 50
LV	2001	2	40	5	8	50-60	2 to 5-8	2-7	0
LT	1998	3	6	6	3-5	6	n/a	4-5	3-4
LU	1990s	few	3-4	3-4	3-6	3-6	0	1 (?)	1 pilot
MT	not yet	0	0	0	0	0	0	0	0
NL	mid 2000	0 (?)	very few	50	50	100	0	15	27
PL	1995	8	<5	3-10	30-50	3-4 (30)	n/a	10-15 (??)[7]	10-20 (??)
PT	n/a	n/a	ca. 7-8	10-12	n/a			10-15	
RO	1996	2	2	14	15-20	20	7	<10	0
SK	1995	10	30	5	6-8	8 (20-50)	n/a	10 (15-20)	40-50
SI	2001[8]	1	1-2	2-5	5-6	5-6	1	4-6	10-20
ES	n/a	10-15	ca.100	> 15	20-60	1000	n/a	20-30 (124)	200-3000
SE	1978	6-12	12-15	5-10	n/a	4-5	6	3 (5-6)	4-8
UK	1966	20	20-24	20	30-50	>50	n/a	25	100

These trends are mostly reflected in a growth of the EPC market in the public sector, too, however a strong ESCO market does not readily translate into a strong EPC market, as shown in the following pages.

[7] As reported in the JRC survey 2016, however probably these include also ESC and other ESCO type projects.

[8] Geissler 2004

3.1 General review of the EPC market prevailance in the public sector

The picture of the current status of using EPC in the public sector is very diverse. There are only a few countries, where a well-developed EPC market could be identified in the public sector (DK, DE, UK), and several which are well advanced (FI, CZ, NL). France is special case, with a moderately advanced EPC market in the public sector, because the EPC definition actually misses the core EPC value, i.e. repayment from the savings, as a result of the French legislation.

Most of the markets are either preliminary, have not started, or are at the stage of pilot or only few projects Table 5.

Table 5 –EPC market status in the public sector.

AT	unsure, probably slight decrease, but large regional differences	**IT**	rather underdeveloped because public sector is less open to EPC (while the overall ESCO market is developed)
BE	pilot project phase, continuous growth	**LV**	preliminary and dependent on subsidies
BG	very small market, slowly increasing trend	**LT**	preliminary
CR	relatively small, growing continuously	**LU**	preliminary
CY	underdeveloped, maybe 2 pilots can start	**MT**	not yet deployed
CZ	well developed, growing	**NL**	boom during the last years, including in the public sector
DK	young, stable market, slowing down	**PL**	EPC is not common, struggles to take-off
EE	has still not deployed	**PT**	emerging now
FI	young, moderately developed	**RO**	stagnant and has not grown for the moment
FR	stable and growing	**SK**	considerable growth until 2015, but halted
DE	stable, large market, still growing, large regional differences exist	**SI**	steady growth
GR	negligible, pilot status	**ES**	slowly emerging besides private EPC market
HU	huge fluctuations, currently down	**SE**	market has been decreasing, and now in rather preliminary level
IE	still preliminary	**UK**	already well developed, use of EPCs is at a rising trend

Sweden, Hungary and Slovakia used to have a relatively well functioning EPC market in the public domain, but for specific reasons the markets have clearly halted. Slovakia stopped just within a year, due to the introduction of state grants for the same beneficiaries, in Hungary the regulatory instability and public liquidity problems (involving also non-payment issues) caused problems, while in Sweden failed projects and a turn towards in-house solutions has put an end to much of the EPC market in the public sector.

Most of the clients for EPC are still related to the public sector across Europe, but – of course – there are exceptions. There are only a few MSs where projects are found in both the private and the public arena (in developed EPC regimes, like in FR, DE, NL and in less established contexts, such as in BE, LU, HU, PT, PL). EPC projects are almost exclusively focused on non-public sectors in IT, ES, SK, LV and LT (though the last two hardly have EPC projects anyway).

Afterall, the most preferred partnership is with public buildings. Practically all EPC projects are in the public sector in AT, BG, DK, CY, FI, GR, IE, RO, SE, UK (Table 6).

Table 6 – Public sector as a client for EPC.

AT	main client	**IT**	both private and public EPC clients
BE	both private and public EPC clients	**LV**	only pilot projects in the public sector
BG	concentrated on the public sector	**LT**	only 3 pilots in the public sector
CR	main client is the public sector (only few other projects)	**LU**	public sector is reluctant to use EPCs (one pilot)
CY	not clear yet (probably public as main client)	**MT**	no EPC projects
CZ	80% of the projects are in the public sector	**NL**	both private and public EPC clients, with more in the public sector
DK	the only sector for EPC now	**PL**	few projects, both private and public sector
EE	not relevant, no projects	**PT**	mostly in the public sector, but also private clients
FI	municipalities are the main client	**RO**	interest would be in the public sector, however the public debt barrier has completely stopped projects
FR	traditionally the public sector, but currently, private is equally involved	**SK**	before 2015, public sector was the main client, but totally halted
DE	both public and private sector targeted	**SI**	majority of projects in the public sector, but private is also important (14 public projects of 20 total)
GR	only public (among the few pilots)	**ES**	mostly private clients, but lately also public projects
HU	no public	**SE**	main client for EPCs is the public sector
IE	only pilots, they are in the public sector	**UK**	main client for EPCs is the public sector

The outlook for the EPC market in the public sector has also been explored. Most of the markets are expecting to grow in the near future, even those that are still in a preliminary phase. This may be overly optimistic, especially considering that some of the barriers listed (in particular the ESA 2010 definition) seems to be a major bottleneck. If this is resolved at the EU level, the forecasts may be realised. See more in Table 7. At the same time, there were many expert interviewees that highlighted that unless conditions changed for the best (usually in terms or more reliable regulatory framework, public debt resolution, simplification of procurement or providing support to develop tenders, etc.), the national markets will not be able to develop (in RO, SK, SI, CZ, SE, ES, PT, PL, etc.)

Table 7 – Expected future development of EPC in the public sector.

AT	Big public EPC projects are to continue, but smaller public EPC projects are seen to be the bottleneck.	**IT**	The success of EPC in the public sector is much hindered by a few key barriers, no boom is expected.
BE	Growth expectations mainly in the public sector.	**LV**	No optimistic forecasts.
BG	Very vulnerable to problems.	**LT**	Unsure development of EPC (ESC is more popular).
CR	The EPC market is on a growing trend, but ESA 2010 is a major problem.	**LU**	Not enough information.
CY	Recent policy improvement can create a favourable environment for market growth.	**MT**	No take-off is expected.
CZ	The public sector is seen as a possible seeding source for EPC in other sectors.	**NL**	Continued growth is expected.
DK	Unclear, because public buildings have saturated.	**PL**	With the current market conditions a development is not foreseen in the near future.
EE	Very unclear, some positive signs combined with negative expectations	**PT**	Unclear, because there is commitment however the market is limited by serious barriers
FI	Continuous growth is expected in the public sector	**RO**	With the current market conditions a development is not foreseen in the near future.
FR	Continued growth is expected.	**SK**	With the current market conditions and barriers, a development is not clear in the near future.
DE	Growth of the EPC sector is expected.	**SI**	Further market growth is expected.
GR	Unsure, because there is high uncertainty in the economy, while there is interest for EPC.	**ES**	A few key barriers hinder an expected level of development.
HU	Unsure, due to policy instability.	**SE**	Depending on market conditions, momentum may be regained.
IE	Unsure, because of lack of information.	**UK**	Continued steady increase is expected.

3.2 Basic features of EPC projects in the public sector

The EPC markets can be described with several indicators. In this section, the main target measures and implementation areas are reviewed, as well as the length of EPC projects in the public sector, as opposed to the private sector projects.

Common target sub-sectors are municipal and governmental buildings, street lighting, schools, hospitals, sport and leisure establishments.

Table 8 – Most common target areas of EPC projects in the public sector.

AT	public buildings, schools, educational sites, public hospitals, street lighting	**IT**	schools, educational sites, street lighting, and public hospitals
BE	public buildings, schools, educational sites	**LV**	two public building pilots and a few streetlighting projects
BG	educational buildings (such as schools and kindergardens) and healthcare facilities, as well as public offices, student dormitories, and street lighting	**LT**	three pilots in the public sector
CR	street lighting and public buildings (including hospitals), water utility establishments	**LU**	one pilot in governmental building
CY	no projects yet – 2 pilots in government buildings	**MT**	no EPC projects at all (also not in the public sector)
CZ	public buildings, schools, educational sites, publicly owned sports centers, student dormitories, public hospital, street lighting	**NL**	schools, municipal buildings, care centre facilities, public swimming pools, museum
DK	insulation of building envelopes, traffic signal installation, street lighting and underground pipelines for water and heating beside energy saving measures	**PL**	public buildings, schools, educational sites, public hospitals, and street lighting
EE	possibility for central government buildings and street lighting (but not seen yet)	**PT**	hotels, hospitals, leisure centre sports, schools and public buildings
FI	streetlighting and public buildings	**RO**	public buildings and street lighting
FR	public buildings, swimming pools, and street lighting	**SK**	earlier: street lighting, others in public buildings, schools, educational sites (currently no activity)
DE	public office buildings, schools, educational sites, public hospitals, and street lighting	**SI**	public buildings, hospitals, sports centers, educational buildings, schools, universities, public lighting
GR	municipal street lighting and public hospitals	**ES**	public buildings, public hospitals, and schools/educational buildings, public

			lighting
HU	one project in street lighting	**SE**	administrative office buildings, schools, hospitals and healthcare centres
IE	only pilot projects, street lighting	**UK**	wide range of public buildings and different sectors including local authorities, the NHS, schools, further education and universities

The length of EPC contract is typical based on the sector. In general, EPC projects are around 10 years long. If public grants or IFI support is involved, the length can be much longer, as well as in more developed markets, where trust is more developed.

In particular for the public sector, the length of EPCs is almost always shorter than in the private projects, probably due to a less enforced pressure on costs, thus more complex projects are possible with longer payback times.

Table 9 – Average duration of EPC projects in the public sector (years).

	public sector	**private sector**		**public sector**	**private sector**
AT	3	10	**IT**	8-9	4-5
BE	10 – 15	5	**LV**	15-20	no info
BG	7-9	no info	**LT**	no info	5
CR	3 - 7 or 12-15	no info	**LU**	no info	no info
CY	not relevant	not relevant	**NL**	8-10	8-10 (?)
CZ	8-12	no info	**MT**	not relevant	not relevant
DK	8 – 25	no info	**PL**	10	<4-5
EE	not relevant	not relevant	**PT**	15	no info
FI	no info		**RO**	2-3	no info
FR	8 - 15 if no financial services > 20 with financial services	< 5	**SK**	10	3
DE	up to 15	5	**SI**	10-15	10-15 (?)
GR	2-3	2-3 (?)	**ES**	<10	10-12
HU	not relevant	7	**SE**	5-10	no info
IE	no info	no info	**UK**	8-10	5-10

Note: (?) indicates an uncertainty communicated by the experts interviewed.

3.3 Common/overarching barriers

Despite considerable efforts to promote the energy services market development, persistent obstacles inhibit the full development of the energy services industry.

This section discusses the key remaining barriers, named specifically to affect the EPC projects in the public sector. A review of the barriers per MS is shown in Table 10.

Table 10 – Key barriers to the development of EPC in the public sector.

AT	- lack of understanding and acceptance - lack of trust - negative experiences - difficulties of raising financial liquidity which is affordable. - financing institutes became more restrictive - lack of tenders for EPC, and low number of respondents - ESA 2010 definition
BE	- as low energy prices - strong focus on payback times - lack of disseminated best practice examples - lack of appropriate in-house expertise - no capacities to properly formulate tenders - reluctance to use the help of facilitators - ESA 2010
BG	- low and unpredictable energy tariffs - lack of information - lack of trust - EPC projects and providers are not eligible for public funding - lack of capacity in public sector for the preparation of EPC tenders - lack of facilitators - ESA 2010 definition
CR	- lack of understanding - low energy prices - lack of standardised procedures and documents, - lack of standardised monitoring, measurement and verification of savings - no interest from commercial banks - very high costs for capital for ESCOs -lack of knowledge on how to prepare and implement a tendering procedure for EPC contracts - ESA 2010 definition
CY	- lack of trust from the clients' side with regards to the procedure and lack of expertise - relatively small market, - high interest rates, -lack of access to finance

CZ	- lack of trust in the model - lack of specific knowledge - split incentives - public liquidity - ESA 2010 definition
DK	- has reached a saturation point - high transaction costs - split incentives - decrease in energy prices
EE	- Off balance sheets investments is not allowed - the public procurement procedures and contracts are too complex, - model contracts and guidelines for EPCs do not exist - lack of technical understanding of EPC among potential clients - Lack of proper mechanisms for funding - ESA 2010 definition
FI	- complex procurement procedures - time consuming processes and high transaction costs - too complex calculations and investment appraisal procedures - lack of knowledge or information - few projects that failed
FR	- complexity of certain markets or contracts, which results in a lack of understanding, thus lack of trust; - The short-term return on investment - Clarifications on the conditions of energy performance guarantees are also required to support the uptake of EPCs on the market - The central barrier is still that the current Procurement law prohibits channelled energy costs savings (i.e. costs savings cannot be used to repay the investments)
DE	-limitations of tendering - EPC seen too complex for the public administration - opt-out option for clients risky for the providers - there should be a mandatory step to check the possibility / viability of energy services in the planning of modernisation measures in the public sector - ESA 2010 definition
GR	- lack of awareness and confidence - financial-related obstacles - need to cut expenses has severed the ability of the public sector to get actively involved - overall market uncertainty
HU	- expectations for grants - procurement of an ESCO project is very difficult

	- overall and transaction costs increase - failed projects - ESA 2010 definition
IE	not enough information
IT	- very small demand - no tenders are announced - lack of confidence and awareness - EPC providers prefer other types of clients (e.g. industry), because of the risk of non-payment by the public clients.
LV	- public procurement and tendering procedures - low quality technical project documentations - insufficient awareness of energy efficiency benefits and financial instruments for building renovation - trust issues - low level of demand - low energy tariffs for heating
LT	- Practice of upgrading public buildings (owned by municipalities or the state) through funding received from the EU Structural Funds which suppressing the development of energy services in this sector. - Savings attributable to energy efficiency improvement measures in the public sector do not remain with the body or organisation but are returned to the state budget. - Complex public procurement procedures. - Limited in-house expertise to carry out an EPC procurement and latter implementation. - High risks due to time-consuming ways decisions at the clients are adopted. - Subsidized prices for heating.
LU	not enough information
MT	no EPC market, focus is on supply optimisation
NL	- supportive environment as of 2016 - municipalities often concerned about out-sourcing - problems with announcing and formulating a tender, for which authorities have limited internal capacities - lack of standardized contract - lack of M&V protocols increase the risks as well as transaction costs - complex decision making structures and procedures - competition with other instruments
PL	- too complex public procurement procedures, which exclusively focus on economic (lowest price) criteria - regulatory instability limits the interest in long-term contracts - EPC contracts are considered as public debt accumulated by local authorities (ESA 2010) - collision of interest with state funded programmes

	- lack of understanding of the ESCO concept - lack of interest for energy services on the market - insufficient promotion of ESCO activities
PT	- in-house capacities are lacking to construct and implement tenders - lack of facilitators, who could mediate between the client and the EPC provider - the promising ECO.AP programme has proven to be not attractive for the moment - projects are not preferred by EPC providers and the financial sector
RO	- Central barrier is the ESA 2010 rule on public debt - EPC definition is not reflected in relevant legal acts - legal and procedural frameworks – including a model contract template – are missing - electronic system for public acquisitions (SEAP) is not yet adapted for complex contracts as EPC - EPC projects are dependent on IFI grants - problems with the payment behaviour of the beneficiaries - procurement process is still too complex, ambiguous and time consuming - insecure decision-making and due to the lack of trust between client and ESCO
SK	- competition with public grants or their promise - obsolete technical state of public buildings hampers the payback of projects - lack of knowledge about the details of contracts and their preparation - ESA 2010 rules to include EPC in public debt
SI	- EPC falls under Public Private Partnership Act and Public Procurement Act, which adds complexity - lack of trained personnel at all stages of EPC project development and implementation - lack of qualified EPC facilitators - distrust and fear - supply side of the EPC market is still very small - ESA 2010 rules
ES	- no fully clear reasons for limited public EPC sector development - lack of trust in the concept, due to a low level of awareness - difficulties in procuring complex projects, such as EPCs - financial constraints due to the ESA 2010 rules
SE	- lack of in-house competence to properly specify the contents of an EPC project/tender by potential clients, - trust issues between ESCOs and purchasing parties, therefore a fear of procurement and concerns about getting locked-up with an unwanted contractor, - a few previous bad experiences, which resulted in the termination of projects, - clients prefer in-house solution, perceiving this as a more cost-effective way to do the same implementation.
UK	- lack of Information and awareness - undervaluing energy efficiency

	- lack of capacity and skills to deliver EPC and to contract EPC by clients

The main shared barriers are reviewed below, divided into: information & awareness, institutional & legislative, financial, market & external, technical & administrative and behavioural. With more projects taken off the ground, it is expected that several entry-level barriers will be overcome in certain countries for the public sector.

3.3.1 Information & awareness

The absence of positive examples and success stories is often an obstacle in markets with little experience in these new concepts. Belgium has shown that the successful public sector cases are not properly communicated, and there seems to be not enough experience among clients. The lack of knowledge among end-consumers of the economic potential for energy savings continues to impede the uptake of energy contracting projects on the market even in more advanced markets such as Germany. Partly as a result of the lack of trusted information, the energy efficiency benefits are often regarded as less certain and energy efficiency is undervalued relative to other investment options. Despite various efforts at different levels, many enterprises find it difficult to recognise opportunities for energy savings, procedures, various options and available products etc. and are thus not able to fully assess the benefits of an energy efficiency investment. Concrete advice (e.g. through targeted, tailor-made information on potential measures and their benefits), cost-effective measuring and metering systems and qualified providers of energy efficiency measures can all help alleviate knowledge-related barriers.

3.3.2 Legislative

The legal aspects related to off-balance sheet investments may affect the ability of the public sector to participate in EPC projects. This is the case in Estonia, but also in other countries. The ambiguity of legal aspects pertaining to service contracts such as title to the installed equipment has been mentioned by Latvia. In a survey carried out in Sweden, procurement procedure rules and legislation relating to the activities of municipal energy companies have been cited as a major barrier.

In order to enable EPC implementation in the public sector, it is inevitable that the tendering procedures of energy efficiency investments in general and EPC in particular is clear and related obstacles to the public procurement of EPC and its accounting are removed. In this line, the EED calls Member States to take measures regarding public purchasing and annual budgeting and accounting, with a view to ensure that individual public bodies are facilitated to make investments in improving energy efficiency and use long-term energy performance contracting.

Germany, Finland and the UK stated in 2015 that no legislative barriers preventing the public sector from accessing ESCO services exist.

3.3.3 Behavioural

Users, clients and investors are faced with the complexity of certain markets and contracts. For example, energy performance contracting is a relatively risky business for energy suppliers and service and requires clear framework conditions and well-defined user behaviour in order to provide sufficient confidence that the investment will be recouped. While this is generally the case with commercial and public service customers, residential end-users represent a higher risk associated with an unpredictable element of user behaviour.

Client distrust of energy services has been cited by almost all countries, including more developed ones (e.g. Austria) and preliminary markets (like Bulgaria), which may be connected to general client risk aversion about EPC models or future uncertainty. Limited confidence in ESCO services (a feature of markets at development phase) or preferences

for in-house solutions are also additional behavioural factors that can act as barriers to market maturation. The latter could be the case for major energy consumers have long since established internal structures and responsibilities to ensure a cost-effective supply of energy (e.g. Austria, Malta). In such cases, energy management systems are already in place and the potential for optimisation is regularly examined.

3.3.4 Market & external

Energy prices have a significant impact on what is cost-effective. Low energy prices mean that short-term returns on investment, in particular for extensive investments and associated services, are difficult to demonstrate. In addition, energy price volatility may have a major impact on the deployment of energy efficiency measures.

In addition, small scale projects are not compatible with energy performance contracting. For example, the reluctance by municipalities to engage in EPCs, which can be in part explained by the small structure of many municipalities, is an impending factor for the uptake of energy performance contracting by the public sector in Luxembourg.

Policy instability, both in general and related to strategies being changed towards energy efficiency or directly for ESCOs is a major impediment in Italy and Hungary. The market conditions can vary during the project, making long term contracts risky.

3.3.5 Financial

Energy-efficiency projects compete for scarce capital with more traditional investments such as small power plants and industrial expansion. Investors might not have sufficient capital and would be forced to draw on their lines of credit in order to invest in energy efficiency measures. Moreover, companies generally add energy costs under overhead costs, and energy consumption is considered as secondary issue with regards to investment decisions. Overall awareness in the area of energy efficiency is generally low among the banking sector (e.g. Estonia). For many banks and financial institutions, the concept of energy services is new.

The administration of ESCO projects contracted by the public sector as part of the public debt is a major, probably the largest and most distributed barrier that arose in recent years, and drastically limits the markets. This problem is explained in detail in Chapter 3.3.8.

3.3.6 Technical & administrative

The lack of technical knowledge, handling of technical risks as well as lack of experience in procurement are issues faced by many countries in which the concepts of EPCs and ESCOs are new. This a key barrier in almost all MSs. Despite its long experience, Germany also refers to technical risks, particularly with complex technical solutions, and operational risks such as adverse effects of processes of changes in product attributes. Hidden costs, such an unexpected maintenance or training needs, may also arise, reducing the savings from efficiency measures.

Energy performance contracting entails relatively high transaction costs associated with compiling information and identifying technically, financially and contractually attractive solutions. Transaction costs are also incurred in preparing projects, from arranging the financing, issuing the request for tender and implementing the measure, and from drawing up the contract. For this reason, contracting is often seen as an option for relatively large projects only. Reducing the transaction costs could help to exploit further market potential.

3.3.7 Public procurement, accounting, measurement and verification

3.3.7.1 M&V

The measurement and verification (M&V) phase has a pivotal role in the overall success of the projects, and especially it is an essential part of EPC projects. Without a proper M&V, collectively agreed between the participating partners, and fully transparent, a guaranteed savings EPC cannot be concluded successfully. M&V determines the project savings which are then used to pay the financing obligations of performance-based contracts. As the energy savings represent avoided energy consumption, they cannot be measured directly and a set of agreed rules in a so-called measurement and verification plan is therefore necessary to establish the actual impact of energy saving measures. The savings must be monitored through an appropriate measurement and verification plan in order to predict accurately the baseline consumption, account for changes in operational and external factors and evaluate the overall performance after the project implementation. The design and implementation of the M&V phase is therefore the foundation to the long-term success of EPC projects.

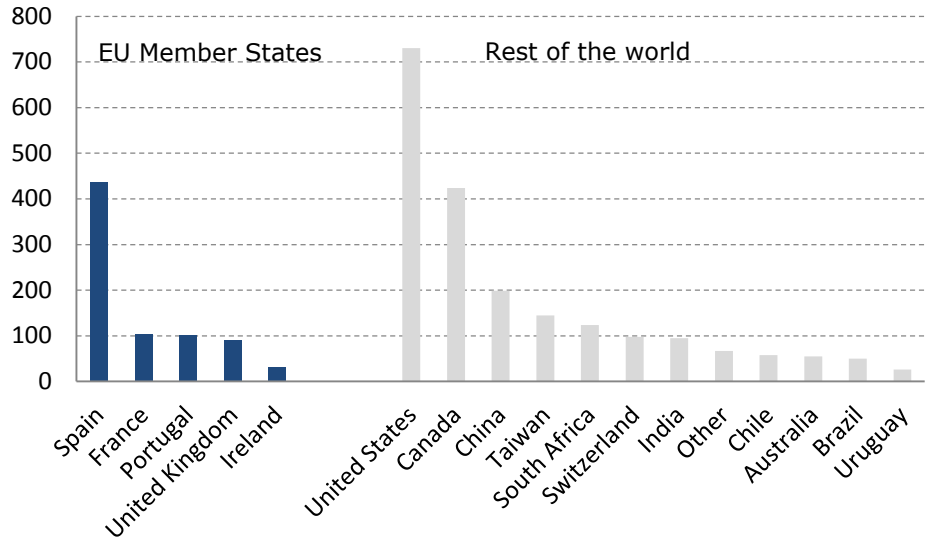
According to (Hansen 2006), M&V can be defined as the set of methodologies that are employed to validate and value changes in energy consumption patterns over a specified period of time, which result from an identified intervention or set of energy conservation measures. Three main components determine the energy savings:

$$\sum Post - implementation\ Energy\ Use - \underbrace{\sum Baseline\ Energy\ Use \pm \sum Adjustments}_{Adjusted\ baseline\ energy\ use}$$

where Baseline energy use refers to the baseline prior to the EPC measures, Adjustments to exceptional changes that are not directly coupled with EPC measures, and Post-implementation energy use refers to the energy usage after the EPC measures. In other words, the energy savings are determined by the difference between the post installation and adjusted baseline energy uses, where the adjusted baseline is a prediction of how the building/plant would have operated had the energy efficient change not been implemented. This confirms the complex nature of measurement of energy savings compared to energy production as the former involves the computation of adjustments to account for weather fluctuations, occupancy changes etc.

M&V can be done in various ways. A standardised method is considered a key element, necessary for strengthening client and financiers' confidence in ESCOs and the energy services market in general. The International Performance Measurement and Verification Protocol (IPMVP) was developed by the US Department of Energy at the end of the nineties to provide guidance to ESCOs on how to deal with EPCs and standardise the ways in which variables and adjustments can be made to baselines (e.g. if building occupancy rises). This protocol is used by many EPC projects as the basis for M&V and it is important that organisations understand the proposed M&V approach (and how it will work during the life of the contract), before the relevant contract is signed. The most recent worldwide distribution of Certified Measurement and Verification Professionals is shown in Figure 13. The Certified Measurement and Verification Professional programme was established by the Association of Energy Engineers and the Efficiency Valuation Organization (EVO) with the dual purpose of recognizing the most qualified professionals in this growing area of the energy industry, and raising the overall professional standards within the measurement and verification field. According to the figures published by EVO, certified professionals exist only in 5 EU Member States, with Spain being the leader.

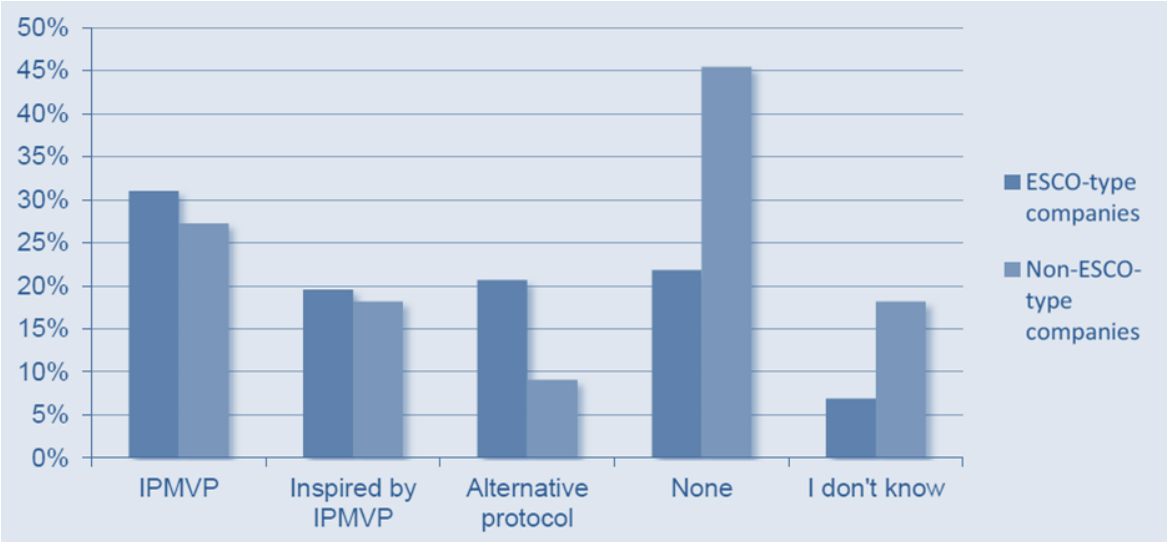
Figure 13 Distribution of certified measurement and verification professionals.



(IPMVP 2014)

In a survey carried out by Donkelaar, et al. 2013 to investigate M&V practices adopted by energy service providers across the EU, it was found that the majority of the organisations (68%) follow an M&V plan. The results were based on 100 questionnaires distributed via European or national ESCO associations, national contact points of the EED Concerted Action, organisations in the JRC ESCO databases and other organisations active in the energy services market. Of the ESCO-type responders, 31% use the IPMVP protocol, 19.5% use a protocol inspired by IPMVP and 20.5% use an alternative protocol. Conversely, 27% of the non-ESCO type organisations use the IPMVP protocol, 18% use protocols inspired by IPMVP, while only 9% use an alternative protocol. The responses also showed that a significant 22% of ESCO-type companies and 45% of non ESCO type companies do not use any M&V protocol.

Figure 14 - Responses given to question "Do you use any M&V protocol" by surveyed organisations active in the energy service sector in 22 EU Member States



(Donkelaar, et al. 2013)

Figure 15 - Overview of the four IPMVP Options (IPMVP 2014)

IPMVP Option	How Savings Are Calculated	Typical Applications
A. Retrofit Isolation: Key Parameter Measurement Savings are determined by field measurement of the key performance parameter(s), which define the energy use of the ECM's affected system(s) or the success of the project. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period. Parameters not selected for field measurements are estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgement. Documentation of the source or justification of the estimated parameter is required. The plausible savings error arising from estimation rather than measurement is evaluated.	Engineering calculation of baseline and reporting period energy from: — short-term or continuous measurements of key operating parameter(s) and — estimated values — routine and non-routine adjustments as required.	A lighting retrofit where: 1) power draw is the key performance parameter that is measured periodically and 2) lighting operating hours are estimated based on facility schedules and occupant behaviour.
B. Retrofit Isolation: All parameter Measurement Savings are determined by field measurement of the energy use of the ECM affected system. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.	Short term or continuous measurements of baseline and reporting period energy, or engineering computations using measurements of proxies of energy uses. Routines and non-routine adjustments as required.	Application of a variable speed drive and controls to a motor to adjust pump flow. Measure electric power with a kW meter installed on the electrical supply to the motor, which reads the power every minute. In the baseline period this meter is in place for a week to verify constant loading. The meter is in place throughout the reporting period to track variations in power use.
C. Whole Facility Savings are determined by measuring energy use at the whole facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period.	Analysis of whole facility baseline and reporting period (utility) meter data. Routine adjustments as required, using techniques such as simple comparison or regression analysis. Non-routine adjustments as required.	Multifaceted energy management program affecting many systems in a facility. Measure energy use with the gas and electric utility meters for a twelve month baseline period and throughout the reporting period.
D. Calibrated Simulation Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility. Simulation routines are demonstrated to adequately model actual energy performance in the facility. This option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data. (Energy end use metering may be used to help refine input data).	Multifaceted energy management program affecting many systems in a facility but where no meter existed in the baseline period. Energy use measurement, after installation of gas and electric meters, is used to calibrate a simulation. Baseline energy use, determined using the calibrated simulation, is compared to a simulation of reporting period energy use.

A poor basis for M&V can create problems such as an unfair allocation of performance risk and savings calculations being unclear or taken for an inappropriate baseline. M&V can be, however, complex since variable factors, such as weather or building occupancy, need to be taken into account during the life of the contract. The NEEAP of the Wallonia Region refers to complex verification protocols as one of the main obstacles to reaching a mature market for energy services while the French NEEAP states that users, clients and investors are often faced with the complexity of certain contracts, which impede the development of the market. Other countries also cite technical problems (e.g. Estonia) as barriers, emphasising the need to develop clear guidelines for M&V.

Generally, an M&V plan should include:

- A clear delineation of the M&V standard selected
- Technical competences of M&V planner
- Deadlines: for M&V plan implementation, M&V equipment installation, M&V reports, et cetera
- Energy saving measures: a description of measures implemented that generates the savings
- Baseline definition: reference period, and parameters for adjustments, et cetera
- Methodology for savings calculation: equations defined, hypothesis considered, data sources for energy consumption (meters, invoices, et cetera) among other considerations
- Measurement specifications: sampling needed parameters to be monitored and the measurement interval

3.3.8 The impact of ESA 2010 on the European EPC sector

The following overview is based on

1) the survey carried out by the Joint Research Center in 2015 on the ESCO markets of the EU MSs,

2) followed up by a more focused survey on Energy Performance Contracting (EPC) in May-June 2016, and

3) the survey on Eurostat guidance note "The impact of Energy Performance Contracts on government accounts" carried out by the European Association of Energy Service Companies (eu.esco) and the European Federation of Intelligent Energy Efficiency Services (EFIEES), in their role as voluntary European co-administrators of the European Code of Conduct for Energy Performance Contracting (EPC), together with the National Code Administrators, taken between 2nd November 2015 and 15th January 2016.

3.3.8.1 Background

The European System of National and Regional Accounts (referred to as ESA 2010) entered into force in September 2014, and raised concerns about how to treat Energy Performance Contracting (EPC) in public accounts.

As a response on 7 August 2015, the Eurostat published a guidance note “The impact of Energy Performance Contracts´ on government accounts”. In line with this guidance, capital expenditure undertaken as part of EPCs should be - in most cases – accounted ''on balance sheet'' for National Accounts purposes despite the fact that the government liability is conditional on a guaranteed service, involving a revenue. Exceptions to this rule are cases where such contracts can be associated with PPPs and operating leases. Given the nature of EPCs, these options remain limited except for certain specific cases. This is considered a major burden to EPC, as public administrations will hesitate to engage in EPC as they might fear of increasing public debt.” (Litiu et al. 2016)

Therefore, ESA 2010 represents a major burden to the ESCO business in the public sector, because public administrations or financial decision makers are hesitant to engage in ESCO projects, in order to avoid the increase of public debt (Litiu et al. 2016). In addition, the interpretation does give a value to the EPC projects that (at least a part of) the investment of the EPC project into the energy efficiency is offset by monetary savings, which is actually guaranteed, i.e. cannot be lost.

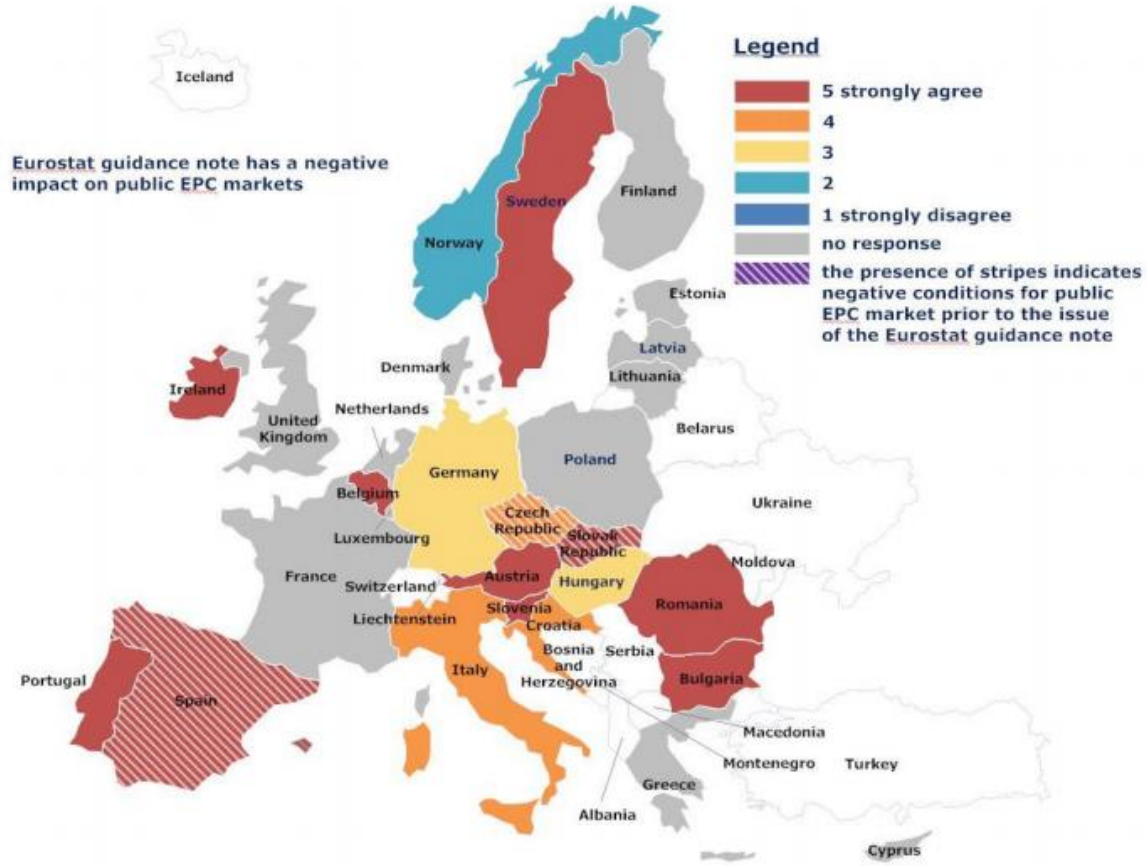
Note that as of early 2017, there is ongoing effort led by Eurostat to review the above mentioned guidance note in order to provide a more flexible accounting framework of EPCs to allow to take into account their specific nature. The results are foreseen for summer 2017.

3.3.8.2 General findings

In 2015, in the JRC survey about ESCO markets, three MS (Spain, Croatia, the Czech Republic) mentioned that the ESA 2010 rule blocked projects and more Member States pointed at the problems related to the ambiguity.

The focused review of the EPC markets regarding the ESA 2010 rule by Litiu et al. (2016) confirmed the negative impact, and the following figure represents what the EPC markets' stakeholders thought about the ESA 2010 in 2015-2016.

Figure 16. Geographical spread of opinion about the impact of Eurostat guidance note across the EU



Source: (Litiu et al. 2016).

Note that the Czech Republic, Slovakia and Spain were less critical about the guidance note of 7 August 2015, because they added that EPC projects in public buildings had already had a negative impact on public debt in their countries before the publication of the guidance note based on the local interpretation of ESA 2010 until then.

As seen above the following MSs: Austria, Belgium, Bulgaria, Ireland, Portugal, Romania, Slovenia, Slovakia, Spain and Sweden strongly agreed with the negative impact (Litiu et al. 2016).

Similar conclusions can be drawn from the survey carried out by the JRC in 2016 on EPC, where 14 countries mentioned or even emphasized this as a key barrier, including Croatia, Czech Republic, Estonia, and Latvia above the previously listed ones.

Based on the above, the ESA 2010 rules on public debt and deficit represent not only a hindrance to the development of public sector EPC projects, but a very serious regulatory obstacle to energy efficiency. In some countries this was mentioned as blocking factor, e.g. in Slovenia and Romania. Besides limiting the ESCO market, possibilities to ensure provisions in line with Article 19, Energy Efficiency Directive (2012/27/EU) are also significantly reduced.

The impact of the guidance note was found to differ on the level of government. Stakeholders from Spain and the Czech Republic stated that EPC was impacting central government' debt. Germany reported that the issue mainly concerned municipalities and the supervising bodies on the regional level. Bulgarian, Slovak and Romanian stakeholders observed a negative impact of EPC on municipal debt (Litiu et al. 2016).

3.3.8.3 Specific examples of negative impact

In Belgium

The growth of the EPC market in Belgium has been quite steady in the last few years (Bertoldi et al. 2014), and decision makers in the public sector expressed their support to EPC, their awareness was significantly improved, while the public ESCOs and other independent facilitators were successful in assisting stakeholders to find each other.

After the ESA 2010 interpretation, many of the public authorities were informed that off-balance sheet financing via EPC was not possible anymore, which they had considered as the key added value of EPC (overpassing other benefits). As a result, it is found to be difficult/impossible to convince politicians and public representatives to choose EPC. According to a think-tank/facilitator (Factor4), a drop of >50% in new EPC projects is expected (reported by Litiu et al. (2016)).

In Bulgaria

There is an even stricter regulation in Bulgaria: the legislation[9] requires that municipal debts do not exceed 15% of the average annual expenditures of the municipality. However most Bulgarian municipalities have already reached this limit, while public buildings and street lighting systems are very obsolete and need urgent renovation (with possible energy savings up to 70%) (Litiu et al. 2016).

On the other hand, it was found in the JRC survey of 2016 that an intermediary solution was implemented, according to which EPC projects are exempted from the limitation. At this moment, the ambiguity may arise from definition and application of the term "EPC".

In the Czech Republic

Energy efficiency projects via EPC have been limited already before the Eurostat guidance note of August 2015, based on the interpretation of ESA 1995 and ESA 2010 by the Ministry of Finance in the Czech Republic. Their impact was major on governmental organisations, which are the so called state-owned buildings ("organisational units of the state" or OUS), because EPC was considered to imply liability from ESCO contracts into the national debt, and therefore the Ministry of Finance does not approve such transactions, and considers these as "secret loans" (Bertoldi et al. 2014). According to Act no. 218/2000, Section 49 OUS are not able to apply EPC because they are legally bound not to receive or provide grants. The only (rather impractical) way to carry out an EPC was

[9] Amendment of the Law on Municipal Debt (Art. 17b) of August 2015, Art. 32, P.1 of the Law on Public Finances (P. 12 of the Transitional provision of the Law on Municipal Debt).

using special-purpose "capital investment" from the state budget (Valentova and Szomolanyiova 2013), but we have no information if this is still possible as of 2016. The possible change to the legal background was explored at that time (Valentova and Szomolanyiova 2013), which is however not relevant after the Eurostat guidance.

As of mid-2015, municipalities, regions were not affected by this interpretation and were active in EPC projects, which has halted as a result of the Eurostat guidance note (JRC 2016 survey).

In Portugal

The Portuguese EPC market was not limited by the issue of public debt until the Eurostat guidance note, because the projects could be accounted as ordinary maintenance and repairs and intermediate consumptions based on the Law of Commitments and Late Payments (Litiu et al. 2016). However, EPCs have to be seen as public debt now, which drastically limits the potential of the market (JRC survey 2016).

Romania

In Romania, the first public procurement procedure to contract energy efficiency services for public buildings was launched in Galati in May 2015 (Transparense project, 2015; Craiova City, 2015). The project serves as pilot program of the European Bank for Reconstruction and Development (EBRD), funded by the Global Environment Facility (GEF). The EBRD program aimed to rehabilitate a number of public buildings matching the financing with energy performance contracting by ESCOs. The buildings related to this program are Galati's Emergency Hospital for Children "Sf. Ioan", and a group of 5 schools of primary education. EBRD provides free technical assistance to municipalities to prepare energy efficiency projects in public buildings (kindergartens, schools, hospitals). Three more projects were involved in the programme, and following the pilot phase, the program was expected to be extended to other interested municipalities to implement energy efficiency projects in public buildings (Craiova City, 2015). However, for the moment, implementation has been delayed due to the ESA 2010 interpretation (JRC survey 2016).

Slovakia

EPC has been just getting off the ground, with the support of relevant legislation, awareness raising, certification and licencing, however municipalities are now restricted from using EPC, particularly those that are near the debt limit defined in budgetary rules. Public decision makers are reluctant to consider EPC as a way to implement energy efficiency investments. Thus, instead of complex solutions with guarantees, they implement partial solutions (most of which in emergency conditions) or implement complex projects financed from grants (mostly ESIF) without guaranteed savings. (Litiu et al. 2016, JRC 2016 survey)

3.3.8.4 Examples of local "solutions"

A few national governments have installed a method or measure that allows the local EPC industry to work with the condition of the hindrance of ESA 2010 rule as a fall-back option until an EU level solution is instituted.

In Austria, bilateral awareness raising was conducted to leverage the uncertainty within public administration on how to procure ESCO contracts without recording such investments on the public balance sheet.

In Belgium, it was found that decision makers that were in support of EPC before and had a general understanding of the advantages of EPC, realised that off-balance sheet financing via EPC was not possible anymore. Because this specific advantage was a strong driver to engage in EPC projects, and it was also an added value easy to explain at the beginning of the „EPC sales process", and the loss of it raised doubts amongst potential clients. As a result, it is expected that the number of new EPC projects will drop by over 50%, and thus in general will impact the development of energy efficiency

projects negatively in general. As a counteraction, Belgian and Dutch EPC supply side stakeholders develop technical and communication solutions to reduce the impact of the Eurostat note.

In Bulgaria, a number of actions were taken to deal with EPC created public debt based on ESA 2010. For example, an amendment was introduced to the above indicated Law on Municipal Debt, based on which municipalities may undertake new debt under EPCs every budgetary year up to 15% of their average annual capital expenditure for the last 4 years. The EPC investments will not be taken into consideration when calculating the general limit of the overall annual liabilities of the municipalities for repayment of debt. Furthermore, the Energy Efficiency Law was changed so that EPC projects can be signed for up to 10 years, instead of the 5 years before. Another amendment to the Public Procurement Law allows that projects are financed by forfeiting - applicable to receivables assignment agreements (including factoring and forfaiting agreements) concluded after 13 May 2014.

In Croatia, the Eurostat definition poses major obstacles for the development of public EPC projects. To overcome this situation, an EPC model contract is being prepared that is standardised for public sector facilities and ensures that the EUROSTAT definition and restriction is respected. It is planned to be presented and accepted for Eurostat.

In Germany the previously spread projects accounted off-balance have dissipated, except for those projects in Berlin, where projects financed with forfaiting must be regarded on-balance.

3.3.8.5 Explanation of "lack of negative impact"

There are a few MSs, in particular Denmark and some parts of Germany, where ESA 2010 and the Eurostat guidance note did not exert major impact. In these cases a non-traditional financing method to EPC projects is applied and therefore municipal liquidity and debt issues are not affected by EPC projects. E.g. in parts of Germany EPC projects are mostly financed via forfeiting, while in Denmark municipalities have no debt issues and can finance projects themselves or by preferential bank loans.

Obviously, in countries like Malta and Cyprus, where the EPC market has not yet kicked off, the impact it is yet to be seen.

3.4 Further business models for EPC in the public sector

The basic models used in Energy Performance Contracting were described in Chapter 1.2.3.

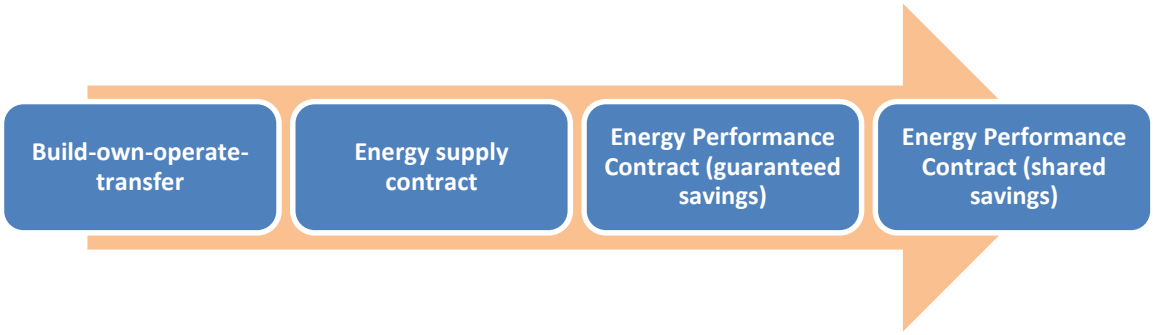
There are some distinct business models, specific for an area or a group of providers that are worth reviewing. Some examples are given below.

3.4.1 Build-own-operate-transfer

Under a build-own-operate-transfer contract, the ESCO designs, builds, funds, owns and operates the scheme for a defined period of time and then transfers the ownership across to the customer. Customers enter into long term supply contracts and are charged according to the service delivered. The service charge includes capital and operating costs recovery and project profit. The contract type has been found to be more applicable when including large energy generation assets e.g. combined heat and power engines.

The relative risk associated with each contract is shown in Figure 17.

Figure 17 - Ranking of different energy contracting types according to growing associated risk level



3.4.2 Single stage vs. two staged EPC

In practice, two options are used for EPC with the public sector in Germany: (1) single-stage EPC and (2) two-stage EPC. In the single-stage EPC, the client receives binding warranty bonds from the potential contractor (ESCO) immediately after the realisation of a preliminary energy analysis and determination of the energy saving potential. The client then concludes standard EPC with the best bidder for the implementation of energy efficiency measures. This model contract is simpler and easier to implement, but is riskier for the contractor (ESCO) since the energy saving guarantees are based on preliminary data (Hessian Ministry of the Environment, Climate Protection, Agriculture and Consumer Protection 2012).

In the two-stage model, after EPC is signed by the client and the best bidder, the contractor carries out a separate detailed energy analysis for the verification of contract conditions. In the case of the detailed analysis which does not confirm conditions from the offer/contract, the client can cancel the project/contract without having to pay for the detailed analysis. In other cases, if the offer/contract conditions are confirmed, the project can continue with stage 2, which includes energy measure implementation. The two-stage EPC model has been implemented for complex projects such as hospitals (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

This model contract includes several documents (templates), whose aim is to describe and simplify the process. The attached documents include: list with planned and agreed energy saving measures that should be implemented by the contractor, structure of investment and list of products (equipment), methods for the calculation of the baseline energy consumption and energy costs, annual energy savings value and payment of service fees[10] (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

The baseline energy consumption can be calculated in three ways:

Baseline energy consumption calculated using a flat rate base (not depending on climate and calculating period).

Baseline energy consumption calculated on pro rate base (depending on calculating (invoicing) period). The calculation is based on the measurement of energy consumption throughout the observation period (year) and does not depend on the climatic conditions (heating degrees days are not taken into consideration). Examples include low voltage electricity consumption.

Baseline energy consumption calculated on basis of measured consumption, which depends on climate conditions. This model is used for the calculation of energy consumption and related costs of gas and oil for heating and district or local heating.

In addition, there are several other contract models (based on EPC) such as:

[10] Water consumption and water costs are taken in account In all calculation for base line consumption and energy savings

- EPC Plus (ESC Plus in Germany)
- EPC Light (ESC light in Germany)
- Technology specific EPC (Technologiespezifisches ESC) and
- Green EPC (Grünes ESC in Germany) (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012)

The EPC Plus model has been developed due to the fact that energy savings resulting from the implementation of standard EPCs are in general not sufficient to cover the costs of renovation of building envelopes and requires much longer contracting period. This model contract includes construction works for the renovation of whole buildings or parts of buildings for achievement of higher energy savings in public buildings. When building envelope measures are deemed as obligatory measures by the client, the client provides an additional payment (annually or only once) to the contractor in order to compensate for the longer payback period. It depends on scope of renovation works (share of the sum related to renovation (construction) works as part of the total investment). The Central element is similar to standard EPC, namely the contractor provides an energy saving guarantee and assumes the performance risk (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

A model contract for EPC Plus has been included in the "Guidelines for EPC for Public Properties" for the State of Hessen.[11] Besides additional payments for construction works for building renovation, this model contract also includes a special regulation for ownership and insurance of equipment and installations, taking into account the performance risk and obligation for maintenance of installed equipment (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

Low or zero investment related energy savings measures can be carried out through the EPC light model. In this case, the contractor offers the implementation of external energy management system with guaranteed savings. The contracting period is shorter by 2-3 years, since no requirements related to pay back are foreseen. The contractor takes over guarantee (performance) for achievable energy savings through optimisation of equipment and processes as well as through the implementation of an energy management system. The payment of the contractor fees by the client is on the basis of achieved results (energy savings). This type of contract is appropriate for clients, who do not have own capacity for sustainable energy management as well as for buildings for which standard EPC is not suitable (e.g. they are too small, with low investment requirements) (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

Technology-specific EPC (Technologiespezifisches ESC) was developed for the implementation of projects focusing on the improvement and renovation of lighting systems in industrial buildings, administration buildings, SMEs and commercial buildings as well as street lighting given that these systems neither correspond to state of the art nor meet the new standards and regulations. This type of contract has been used in practice for the renovation of street lighting systems (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

The model contract for Green EPC was developed by the Berlin Energy Agency in 2010. This contract is also based on EPC with significant incorporation of renewables. Green EPC has been implemented as a pilot project in municipalities. After the evaluation of results of pilot projects, it is expected that it will be implemented in other municipalities. The implementation of this type of contract has been supported by the Federal Ministry

[11] Model Contract for EPC Plus and additional documents to it can be found on : http://www.energieland.hessen.de/energiespar-contracting

for Environment, Nature Conservation, Construction and Nuclear Safety (Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection, 2012).

3.5 Financing options

When reviewing past and current practices for energy efficiency financing using ESC/EPC projects, there are a number of variants that are widespread in the EU.

First of all, there must be a differentiation among projects financed entirely or partly by the client. In these cases the ESCO participates in the project as a manager and/or as a guarantee supplier, but not as a financier.

It may also happen that the investment costs are born entirely or partly by the supplier/ESCO, which is part of the ESCO project offer, in such a case.

It is also very common, in particular in the initial phases of the ESCO market development that national funds, international financing organisations streams are involved in project financing. This will drastically increase the economics of the project(s), reduce transaction costs and/or significantly reduce the payment period.

Furthermore, a third (or even forth) party may be involved, which has been traditionally referred to as Third Party Financing, which is considered as a higher developed level of ESCO options. The following market based alternatives[12] were identified, and used in the survey distributed to EPC market stakeholders:

(1) On-Balance sheet (Debt financing)

Situation in which investors lend a certain amount of money on credit in exchange for repayment plus interest. The most common energy efficiency financial product is a loan directly to the client (owner of the premises) or to the ESCO – this is known as third-party financing.

(2) On-Balance sheet (Equity financing)

Situation in which investors lend a given amount of money in exchange for a stake in a project. The most common example of equity financing is private equity. With respect to energy efficiency businesses, equity investment can take the form of an ESCO issuing additional shares in the company's common ownership.

(3) On-Balance sheet (Mezzanine Financing)

Mezzanine financing is a hybrid form of financing that combines debt and equity financing. In most cases, debt will be ranked as a preferred equity share. Mezzanine debt financing is thus riskier than traditional debt-financing but also more rewarding; it is associated with a higher yield. Mezzanine financing also allows a lender to convert debt capital into ownership or equity interest in the company if the loan is not paid back on time and in full.

(4) Off-Balance sheet (Project Financing)

Project finance (PF), by contrast to balance sheet financing (loans, debt and equity), bases its collateral on a project's cash flow expectations, not on individuals or institutions' creditworthiness. It is off-balance sheet financing. A typical PF is divided between debt and equity financing.

(5) Off-Balance sheet (Leasing)

Leasing is the energy market's common way of dealing with initial cost barriers. It is a way of obtaining the right to use an asset. Finance leasing can be used for energy efficiency equipment, even when the equipment lacks collateral value. Leasing companies, often bank subsidiaries, have experience with vendor finance programs and other forms of equipment finance that are analogous to energy efficiency . Leasing is the

[12] The definitions were developed using those in Transparense project (www.transparense.eu) and earlier JRC reports.

most common form of equipment manufacturers' vendor financing, which is often applied in the case of CHP equipment. Leasing is often done as part of a SPV.

(6) Special Purpose Vehicle (SPV)/Special Purpose Entity (SPE)

A firm or other legal entity established to perform some narrowly-defined or temporary purpose, which facilitates off-balance sheet financing of projects. A standard approach is to form a SPV/SPE and place assets and liabilities on its balance sheet to isolate the financial risk. The investors accomplish the purpose for which an SPV /SPE has been set up – for example implementing a large energy efficiency project – without having to carry any of the associated assets or liabilities on their own balance sheet.

4 Member States' assessments

4.1 Austria

4.1.1 Snapshot of the overall ESCO market

The Austrian ESCO market is considered to be a **well-established** market. As of 2015 around 40 companies provided energy services, of which **15-20 are EPC providers** (JRC 2016, Windsprenger et al., 2014). This is a **minor decrease** in the number of companies compared to previous years; evident on the national level, but does not translate to an overall decrease of the market size. In addition there are major regional differences, and for example, the EPC market in Upper Austria has been increasing.

Enabling policies are diverse and **facilitators** are common (see more in Boza-Kiss et al. 2017).

4.1.2 Market status of EPC in the public sector

The Austrian **public sector is the main EPC client**. Municipalities are considered by EPC providers to be reliable partners for long term contracts with a great potential for energy efficiency improvements. The public sector also plays an exemplary role for other sector clients and has exerted a scale of economies effect on the EPC market.

Most commonly targeted areas are **public buildings, schools, educational sites, public hospitals, and street lighting** (JRC 2016).

Typical measures include **thermal improvements** of building envelopes, installation of new systems for **heating and cooling**, optimization of heating systems, **organisational changes** and **renovation of peripherals**. **Street lighting** projects have increased in numbers significantly recently.

It is common to **bundle public buildings** into different "pools", and focus on certain renovation measures to reach economies of scale (and therefore cost savings). Some pools cover heat and electricity, some only heat (Windsprenger et al., 2014).

4.1.2.1 Project duration and financing

The average duration of EPC projects in the public sector is around **3 years**, as compared to an average of 10 years in case of the private clients (JRC 2016).

Experts interviewed in 2016 have varying experiences about the source of financing typical in Austria (JRC 2016). In general it is common to involve **financial institutions** in the funding of EPC projects. For larger projects, the **EPC provider** often also contributes. Both **leasing and forfaiting** are common, while SPVs are not seen in the market, and only very few mezzanine financing has taken place.

4.1.3 Barriers to EPC in the public sector

Even though the ESCO market is rather well developped, many and various barriers have been identified. In general the ESCO market still fights the **lack of understanding and acceptance**. There is an overall **lack of trust** in the ESCO industry. These originate from **negative experiences** in previous EPC projects and give way to prejudices like "The ESCO saves energy costs by reducing the user comfort".

An important barrier is posed by the increasing **difficulties** of **raising financial liquidity** which is affordable. In recent years, **financing institutes became more restrictive** in granting credits. The financial **creditworthiness** is mainly an issue for smaller municipalities because they are not able to borrow.

The level of awareness and knowledge of the ESCO/EPC concepts is still limited, and therefore there are **no tenders for EPC**, expect for a few regions, where intensive dissemination and training have taken place. Even in places where tenders are

announced, the **number of tenderers is very low** or none. Smaller municipalities are not familiar with the legal requirements for public tendering of contracting projects. As a result there is a relatively low number of new investments, which limits the activities and ability of the supply side.

4.1.3.1 Limitations because of compilation of public debt[13]

Based on the interviews carried out in the framework of the Transparense project, it was found that the consideration of EPC as public debt is uncertain in Austria, however respondents to the JRC survey clearly indicated the **ESA2010 rules as restrictive and major** (JRC 2016).

The announcement of the Eurostat guidance note of 7 August 2015[14] raised concerns about the procurement and accounting of ESCO projects, and has discouraged many potential clients, and it is difficult to turn around again.

Legally, EPC should become part of the public debt, however involved **public authorities work around this on a case-by-case level** (Litiu et al. 2016). To the knowledge of the authors, there are no activities ongoing in Austria to clarify the EPC-related accounting and budgetary rules.

4.1.4 Outlook

Big public EPC projects are expected to continue as the biggest public authorities are experienced and have positive attitude towards EPC. Smaller public EPC projects as well as private EPC projects are seen to be the bottleneck.

4.2 Belgium

4.2.1 Snapshot of the overall ESCO market

The energy service market in Belgium is considered **stable and moderately-sized**. The number of ESCO companies remained unchanged for the last few years, with a total of **10-15 companies** (JRC 2016). Furthermore, there are **three public ESCOs**, which typically provide a basis for third part financing, since they are able to provide an advance payment and be repaid from the annual savings. They can usually allocate a substantial budget to be spent on energy performance improvements, often in the form of a revolving fund (Government of Belgium, 2014).

The public ESCOs are considered as the main driving force of the market (Government of Belgium, 2014).

4.2.2 Market status of EPC in the public sector

In recent years, the **awareness** of public authorities as well of the regional public authorities **increased considerably** about EPC, which is partially the result of a **number of promotion activities**. As a result, the demand for EPC-projects started to grow, even if the total number so far is still low, as it is estimated to be around **5 running projects in the last 3 years** (JRC 2016). There continues to be a slight growth in the appearance of (pilot) projects.

The standard measures are measures that can be applied to all buildings which are mainly connected to **energy management and monitoring of energy consumption in the buildings**. The cross sectorial measures are measures implemented following the analysis of separate buildings. These actions are directly related to the weaknesses of the building in question and significantly improve its energy efficiency.

[13] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

[14] http://ec.europa.eu/eurostat/documents/1015035/6934993/EUROSTAT-Guidance-Note-on-Energy-Performance-Contracts-August- 2015.pdf/dc5255f7-a5b8-42e5-bc5d-887dbf9434c9

4.2.2.1 Duration and financing

Regarding the size of the projects, the public sector is mostly interested in **large projects with over >€1.000.000 value and contract lengths of between 10 – 15 years** (as opposed to between €50°000 and €150°000 in value and around 5 years for private (SME) clients (JRC 2016).

4.2.3 Barriers to EPC in the public sector

There are only few barriers directly linked to the EPC market specificities. However, the market is limited by **general energy efficiency barriers, such as low energy prices and a strong focus on payback times**.

There is a need for **best practice examples** to be disseminated in order to enhance knowledge and assist in successful implementation.

There is a major issue with the **lack of appropriate in-house expertise** at municipalities and other public authorities, which have **no capacities to properly formulate tenders**, select the best bidder and control the implementation. This problem could be relieved with the **help of facilitators**, but clients are reluctant to use them, which results in sub-optimised projects, or even in a lack of tenders.

4.2.3.1 Limitations because of compilation of public debt[15]

It was found in 2015 that the ESA 95 was not a major restriction because it was not applied at the municipal level. However, with the announcement of the EUROSTAT guidance note, the ESA 2010 has become an important restriction (JRC 2016).

On the other hand, the actual impact depends on the region, because for many cities the indebtedness tolerance is high (Szomolanyiova et al. 2015).

4.2.4 Outlook

The energy service market in Belgium is considered to be relatively stable with some growth expectations coming mainly from both EPC and ESC projects facilitated by the public ESCOs and facilitators, **mostly in the public sector**.

4.3 Bulgaria

4.3.1 Snapshot of the overall ESCO market

The Bulgarian ESCO market is **very small** registering 12 EPC providers as of 2015 (Nikolaev et al. 2015), and as of 2016, the number of **active EPC providers is put at around 8-15**, with a slowly increasing trend. On the other hand, **fewer than 10 projects** have been started between 2014 and 2016, almost all in the public sector (JRC 2016).

4.3.2 Market status of EPC in the public sector

The ESCO activity is **concentrated in the public sector** with only few projects realised in the private and industry sectors (Nikolaev et al. 2015, JRC 2016). The main benefit of public sector projects in Bulgaria is their **reliability of payments**.

EPC project in the public sector primarily target **educational buildings (such as schools and kindergardens) and healthcare facilities, as well as public offices, student dormitories, and street lighting** (JRC 2016).

The most common measures include replacements or upgrades of the **heating installations**, insulation of **building envelopes and window** replacement (European Labour Institute & Sofia Energy Agency, 2013), or improvement of the **lighting system**

[15] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

(Nikolaev et al. 2015). **Full renovation** of buildings is also seen amongst public clients (Nikolaev et al. 2015).

4.3.2.1 Project duration and financing

EPC projects in the public sector range between **€200 000 and €500 000 of investment volume**. The project length is in the range of **7-9 years** (JRC 2016).

The main player for financing both EPC and ESCO energy efficiency investment projects in Bulgaria is the Energy Efficiency and Renewable Sources Fund (EERSF). While the banks require high percentage of clients' own sources and complex rules, the EERSF require a maximum of 10% clients' own sources, fixed interest rate, without taxes and commissions. Nevertheless, financing by the EPC provider and/or by third party (bank) is not unknown.

4.3.3 Barriers to EPC in the public sector

There are a variety of barriers to EPC in Bulgaria. These can be grouped into three types. There are those, which are general barriers to energy efficiency investments, such as **low and unpredictable energy tariffs**. It is expected that with the growth of energy prices in the future, the pressure on cost savings will drive the attention to EPC.

The second group of barriers are those that apply to EPC in general. For example, there is a central problem with the **lack of information** about EPC providers, EPC best practices. This and a general opposition to outsource cause a **lack of trust** – which has been treated lately through the establishment of industry codes and provider registries.

Furthermore, **neither** EPC (as scheme) nor the EPC providers (as beneficiaries) **are eligible for public funding** (excluding EERS Fund).

The third group of barriers are specific in the public sector. Most importantly, there is a **lack of capacity in public sector for the preparation of EPC tenders**, and **facilitators** that could assist in this are not known.

Finally, there is a legal limitation of the amount of EPC contracts for municipalities, which is linked now to the ESA 2010 definition of public debt.

4.3.3.1 Limitations because of compilation of public debt[16]

EPC is regarded as public debt in Bulgaria, and this forms one of the major barriers to EPC in the public sector (see above) (Szomolanyiova et al. 2015). Furthermore, the legislation[17] requires that municipal debts do not exceed 15% of the average annual expenditures of the municipality, which is a **strict threshold**. But most Bulgarian municipalities have already reached this limit (Litiu et al. 2016).

On the other hand, it was found in the JRC survey of 2016 (JRC 2016) that an intermediary solution was implemented, according to which EPC projects are exempted from the limitation. At this moment, the ambiguity may arise from definition and application of the term "EPC".

4.3.4 Outlook

As a newly established market, EPC market is very vulnerable to problems. As the EPC market is based mainly on the public sector, understanding EPC as public debt is very destructive. This is a pity because public building renovations have a huge EPC potential in Bulgaria.

[16] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.
[17] Amendment of the Law on Municipal Debt (Art. 17b) of August 2015, Art. 32, P.1 of the Law on Public Finances (P. 12 of the Transitional provision of the Law on Municipal Debt).

In general, it is expected that in the next 4-5 years EPC market will develop and more companies will offer Energy Performance Contracting. However, the removal of key barriers is essential.

4.4 Croatia

4.4.1 Snapshot of the overall ESCO market

The Croatian ESCO market is **relatively small**, even though it **has grown continuously** since 2012. HEP ESCO, a public ESCO company the main provider of energy services, but there are new entrants gaining importance, **in particular in EPC**. As of 2016, around 10 ESCO companies operate in Croatia, of which **5 are EPC providers** (JRC 2016).

4.4.2 Market status of EPC in the public sector

The **EPC market is still minor** compared to the general energy services activity. EPCs were introduced for the energy renovation of public buildings in the framework of the Programme of Energy Renovation of Public Sector Buildings 2014-2015[18] (Ministry of Economy, 2014).

However, the number of implemented EPC projects is very low, below 10 during the last few years.

The targeted clients of EPC include mainly the **public sector, such as street lighting and public buildings (including hospitals)**, as well as **water utility establishments**.

4.4.2.1 Project duration and financing

Smaller projects (e.g. street lighting) are in **the value of €200,000 - €500,000**, while larger ones (buildings) range between **€1,000,000-€5,000,000**. In terms of project length, the small ones are contracted for **3-5 years**, longer ones for **12-15 years**.

4.4.3 Barriers to EPC in the public sector

At the moment, the distribution of EPC is limited due to the **lack of understanding** by potential clients of the general benefits of energy services, and little it is understood what the added value of EPCs could be. Indeed, the relatively **low energy prices** limit the profitability of energy efficiency investments in general in case of 10 years contract duration.

The market has a general **lack of standardised procedures and documents**, which could help in more generalised application of the scheme. There are too many firms that claim to be ESCOs or EPC providers, loosening the market trust. In particular, **standardised monitoring, measurement and verification of savings** would be helpful to make the market more transparent.

EPC projects **are not very appealing to commercial banks**, and they require a lot of guarantees and collaterals from their clients (ESCO firms) and strong EPC contracts. There is a lack of appropriate financial mechanism for the EPC model fit for the local circumstances. The **very high costs for capital** for ESCOs make lending for private ESCOs very expensive in comparison with own investments. At the same time, for the public sector, financing is partially provided by the Fund in the form of grants. EPC contracts should be possible to place on **off-balance sheet**.

[18] A few of the assumptions are that EPC should be based on the Public Procurement Act, savings are to be verified by energy auditors and an expert commission; the contract duration maybe up to 14 years, after project implementation (energy renovation of building) , the contractual parties are obliged to monitor energy consumption.

In the public administrations, there is a **lack of knowledge on how to prepare and implement a tendering procedure** for EPC contracts. A nationally developed guidance on tendering methods and documents, as well as model contract documentation would be helpful.

4.4.3.1 Limitations because of compilation of public debt[19]

As of 2015, the accounting of EPC as public debt depended on the legal approach used (public procurement or public private partnership). If public private partnership was used (mainly concessions), accounting EPC as public debt was not an issue in general (however dependent on the Ministry of Finance interpretation). Interestingly, few years before EPC contracts were always qualified as public debt/lease.

With the announcement of the EUROSTAT note, the share of public and private investments in a PPP scheme possible for deep renovations had to be changed from the theoretically optimal of 60:40 to 40:60. Testing this setting resulted in a lack of interest from the EPC suppliers (Stanicic 2016 pers.com.). As a result, the national targets set in the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings are not going to be met.

4.4.4 Outlook

It is foreseen that the EPC market is on a growing trend, although it is still minor in comparison to the overall ESCO market. The EPC projects are focussed mainly on the public sector, as result of the legal indications. However, the ESA 2010 definition of public debt and PPP scheme share is a major deterrent for this development.

4.5 Cyprus

4.5.1 Snapshot of the overall ESCO market

The ESCO market in Cyprus has been long awaited to start off the ground, but it is currently still **underdeveloped**. While **19 ESCO companies** were registered in the official registry as of the end of 2015[20], the number of potential EPC providers is not known. **None** of the companies are really **active** in EPC.

4.5.2 Market status of EPC in the public sector

A contract notice was launched in 2015 for the energy upgrading of **two public buildings** through energy performance contracting. The two chosen buildings are the Central Offices of the Department of Public Works and the Central Offices of the Department of the Electrical and Mechanical Services, which are of G and D energy class, respectively. In the next years, a number of energy efficiency contracts are expected to be signed by public authorities in the context of Cyprus' commitment to an annual energy upgrade of 3% of the useful floor space of buildings owned by the central government. At this stage, it is impossible to make any estimations on the number of contracts (Piripitsi, K; Stougianis, E; Thomas, G; Kakouris, M, 2014).

4.5.2.1 Project duration and financing

No information due to the low level of development of the EPC market.

4.5.3 Barriers to EPC in the public sector

The Cypriot energy market is different from those in other EU countries, but many of the barriers to EPCs in the public sector are shared. For example, there is a strong lack of trust from the clients' side with regards to the procedure and lack of expertise (to tender or manage) and experience of EPC providers. In addition, the relatively small market,

[19] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.
[20] increasing from only 5 on 08 April 2015

high interest rates, and the lack of access to finance are also important factors, which hinder the development of the market (Maxoulis, 2012). Verifications of savings – and safeguards – are also regarded as important barrier (Charalambous, 2013).

4.5.3.1 Limitations because of compilation of public debt[21]

No information due to the low level of development of the EPC market.

4.5.4 EPC market size and potential in the public sector

No information due to the low level of development of the EPC market.

4.5.5 Outlook

It is expected that recent policy actions can create a favourable environment for market growth.

4.6 Czech Republic

4.6.1 Snapshot of the overall ESCO market

The ESCO market in the Czech Republic is considered **well developed**. After a tipping point in 2001, it has been continuously growing. More than 200 ESCO projects have been implemented, many of which EPC projects. As of 2016, there are **8-10 active EPC providers**, which focus on the provision of guarantee based energy performance contracts. About **half of them (5-6 companies) have a long experience** with EPC-based projects on a regular basis.

4.6.2 Market status of EPC in the public sector

Around 80% of the projects are realised in the public sector in the Czech Republic, namely in public buildings, schools, educational sites, publicly owned sports centers, student dormitories, public hospital. The number of street lighting projects has been growing lately.

Typically, EPC-based projects aim to decrease the heat consumption and therefore the implemented measures in most projects focus on the replacement of boilers, installation of heat recovery or heat exchangers, installation of boiler controls, etc. (Valentova & Szomolanyova, 2013).

4.6.2.1 Project duration and financing

The average length of EPC projects in the public sector is between **8 and 12 years**.

4.6.3 Barriers to EPC in the public sector

There are not many barriers to EPC in the public sector in the Czech Republic, but some of them are rather significant. It seems that the primary barrier to more public sector targeted EPC is the **lack of trust** in the model. Public building decision makers are not typically ready to undertake public tenders for EPC, due to habits and **lack of specific knowledge**.

Split incentives are also one of the obstacles to the implementation of EPCs in public entities. The public facility managers have limited access to bills and cannot control the energy consumption of facilities, since the bills are taken by owners of buildings as state or local authorities. Managers are therefore not very much motivated to carry out energy efficiency projects. Some of public entities can benefit from energy savings, but other cannot (Valentova & Szomolanyova, 2013).

[21] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

Furthermore, **public liquidity** raises problems because EPC is either prohibited in public organisations all in all, or they add up on the debt level thus seriously limiting their possible application (JRC 2016)

4.6.3.1 Limitations because of compilation of public debt[22]

The ESA 95/2010 understanding of EPC was already evident in the Czech Republic for years. It started with the restriction to implement EPC contracts in the "Organisational Units of State – OUS", which are the largest part of public facilities owned by the state. The OUS were neither allowed to receive nor provide supplier loans to finance projects pursuant to the Section 49 of Act no.218/2000. They could receive loans only from special "capital investments" provided by the state budget. EPCs were allowed to be implemented only in "allowance organisations", which are public entities partially funded by the public budget (Valentova & Szomolanyova 2013, Department of Electrical Engineering 2014). The latter EUROSTAT definition of 5 Aug. 2015 of public debt has practically **stopped the possibilities for EPC implementation** in governmental buildings.

4.6.4 Outlook

The governmental sector is hoped to become more open to the implementation of EPC projects, while it is also expected that more regions and towns will use the EPC scheme to improve energy efficiency. The public sector is seen as a possible seeding source for EPC in other sectors, too.

4.7 Denmark

4.7.1 Snapshot of the overall ESCO market

The Danish EPC market is regarded as a relatively **young market** with a history of ca. ten years.

As of 2013, there were about 15-20 active companies offering EPC in Denmark, a number which has dropped slightly, and there are **about 6-10 active EPC providers as of 2016** (JRC 2016).

4.7.2 Market status of EPC in the public sector

The emergence of the EPC industry in Denmark can be mainly attributed to the **public sector's overall aim to improve the energy performance of their building stock**. This, accompanied with the **lack of in-house expertise** to realise this aim in certain municipalities pushed the public sector to involve an external party such as ESCOs (Ramboll 2014, Bertoldi et al. 2014, JRC 2016).

As of 2016, there is a **saturation phase**, whereas the number of new projects has been decreasing, with about 3 projects/year for the last 3 years.

The first generation of projects was based on **incomplete energy consumption data** for the baseline. Financing with own client equity (municipalities or other public authorities) was the most used financing form for these projects and total investments were in the range of DKK 20-30 million. Second generation projects have been larger, with longer contracting period (up to 20 years) than the preceding ones. These projects included measures with longer payback time such as **insulation of building envelopes**. Third generation projects, developed since 2013, mostly focused on municipalities and include **traffic signal installation**, **street lighting and underground pipelines for water and heating beside energy saving measures** (Ramboll, 2014).

The most popular target sectors are **public buildings, schools, educational sites, public hospitals, and street lighting** (JRC 2016).

[22] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.7.2.1 Project duration and financing

The size of the projects has been constantly growing and the overall market size has been increasing accordingly. EPC projects have an average size of €6.7 million investment costs, however the largest projects is around €22 million (JRC 2016).

Most municipality projects have been carried out by private ESCOs, under guaranteed savings EPC model, and **financed by the municipalities themselves**.

The typical contractual period of these projects has been between **8 and 10 years**. However longer projects of up to **25 years** are not uncommon.

4.7.3 Barriers to EPC in the public sector

The newly experienced halt in the growth of the EPC market, is due to a **saturation** point, whereas municipalities that were interested in EPC are already involved in project(s), and others that refuse EPC solutions cannot be convinced. These latter ones prefer and are able to implement projects on their own, and it has been shown that both solutions work well, when tailored to the local circumstances.

The key claim against an EPC project in the municipalities that resist is the **high transaction costs** related to the inherent complexity of energy service contracts. Disputes between EPC providers and clients may rise more often in these situations, e.g. when the clients do not accept ESCO claims on reduced performance (lower energy savings) due to external unexpected factors (Jensen, et al., 2013). To overcome the issue with the high transaction costs, ESCOs offer to increase the overall project size by **bundling small projects together** (e.g. consider the renovation of several buildings instead of one or two buildings) as well as to include buildings with higher energy saving potential (JRC 2016).

Finally, **split incentives** have been identified as key barriers in areas where the EPC market has not set foot. There are no contractual schemes that could properly manage the mismatch in interest yet, and the large potential offered by rented sites and properties, should be tapped in the future (JRC 2016).

As an external barrier, the decrease in **energy prices** has impacted immensely on the interest in participating in EPC projects, and gave an additional reason for reluctant municipalities to stay away. However, as prices are expected to grow back slowly, the economics of EPC projects will be established again (JRC 2016).

4.7.3.1 Limitations because of compilation of public debt[23]

The consideration of EPC as public debt **is not a problem** in Denmark for almost any municipality because there are no liquidity issues.

4.7.4 Outlook

It is foreseen by local experts that the public authorities which were open for EPCs have already carried out the key investments, and therefore few public entities and municipalities will engage in new EPC projects. On the other hand, the EPC market may be driven by the healthcare sector or other private sectors in the future (JRC 2016).

4.8 Estonia

4.8.1 Snapshot of the overall ESCO market

The ESCO market in Estonia **has still not fully deployed**. There are **less than 10 companies** providing different types of energy services, but only 2-3 could act as ESCOs, and **even these have difficulties to offer EPC** or guaranteed energy savings models.

[23] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.8.2 Market status of EPC in the public sector

The energy service market is **not yet developed** in the public sector despite the call for the sector to have a leading role in using the ESCO concept.

Nevertheless, the EBRD sees a **possibility for central government buildings and street lighting** to apply EPC.

4.8.2.1 Project duration and financing

Not relevant point because of the lack of projects.

4.8.3 Barriers to EPC in the public sector

The EPC market in Estonia faces several legal, financial and technical barriers: many of them are highly relevant for the public sector.

According to the Estonian public sector legislation (already before the EUROSTAT note on clarification of ESA 2010), contracts for energy services **are to be taken as debt** by local administration. Local governments can make investments, which will result in increase of its indebtedness of up to 60% of its revenues. **Off balance sheets investments is not allowed**, although there have been exceptions with EU water management projects in the past. Moreover, **the public procurement procedures and contracts are too complex**, while **model contracts and guidelines for EPCs do not exist**.

Lack of technical understanding of EPC among potential clients (mainly public enterprises) is another barrier to market growth.

Lack of proper mechanisms for funding ESCO contracts is also one of the barriers, whereby the main issue is that ESCOs do not have their own equity to finance projects on long terms (5-10 years). Commercial banks are reluctant to fund EPC projects, partly due to the lack of understanding of benefit of projects. They perceive ESCO projects as very risky and therefore require higher collateral and interest rates. On other hand, ESCOs are afraid of the possibility of investment repayment failure from the clients' side.

4.8.3.1 Limitations because of compilation of public debt[24]

The ESCO market has been damaged in the last few years as a result of the EUROSTAT definition of public debt.

4.8.4 Outlook

It is difficult to predict the future of EPC and in particular that in the public sector. There have been a number of positive changes, such as adopting several strategies aiming to reduce energy consumption and improve energy efficiency, especially in the building sector (residential and public). On the other hand, legal conditions (public procurement) and available standard documents need to be developed in order to take a kick-off step.

4.9 Finland

4.9.1 Snapshot of the overall ESCO market

The Finnish EPC market kicked off around 2000, and it is considered a **relatively young, moderately developed** market. There are 6-8 active ESCOs on the market[25].

[24] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

[25] Motiva is , a state owned company established in 1993, operates as an affiliated Government agency to provide companies, public sector and consumers with information and solutions leading to resource efficient and sustainable choices. Its ESCO register is available at: http://www.motiva.fi/toimialueet/energiakatselmustoiminta/esco-palvelu/esco-hankerekisteri/esco-yritykset_suomessa (expected to be updated in 2016)

4.9.2 Market status of EPC in the public sector

Municipalities are the main client for ESCO services in Finland. Between 2009 and 2015, **a total of 80 projects** were realised, and there have been **about 12 subsidised EPC projects** during the period 2014-2016.

Projects are fully focused on **streetlighting and public buildings**.

For implementation purposes, Motiva has prepared a guidebook for public procurement. This, however, was not followed properly and some projects were stopped for investigations.

4.9.2.1 Project duration and financing

Project sizes range between below €200 million investments for streetlighting, and between €500-1000 million for public buildings.

4.9.3 Barriers to EPC in the public sector

In terms of barriers, **complex procurement procedures** for energy services in municipalities form one of the major barriers to the development of the ESCO market with regards to the public sector. Public procurement legislation makes tendering procedures for energy services (ESCO) difficult with **time consuming processes and high transaction costs**. In addition, the contractual agreements are not well recognized in public procurement procedures (Sinkkonen, 2013).

Problems in **financing** are mostly related to EPC project funding c**alculations and investment appraisal procedures.** Especially difficult is the way how funding provided by an ESCO should be compared to client's own project funding. If the client has not calculated their own financial cost, the EPC might appear too expensive compared to the situation in which the project is carried out in-house. In addition, sometimes financial institutions are not able to evaluate the true value of EPC projects (Sinkkonen, 2013).

Generally, clients are confident with EPC providers. The problems with mistrust with ESCOs are mainly connected with the **lack of knowledge or information** about ESCO services and benefits of projects among potential clients and to the **few projects that failed** in the recent past. Energy consumption is often not included in core processes, and therefore companies not seen interesting and profitable investment in energy efficiency (Sinkkonen, 2013).

4.9.3.1 Limitations because of compilation of public debt[26]

The consideration of EPC as public debt **is not a problem** in Finland for almost any municipality because there are no liquidity issues.

4.9.4 Outlook

Finland has a lot of the necessary market pre-conditions for an active EPC business in the public sector. The overall legislative framework is favourable and EPC projects have easy access to financial sources. The voluntary agreement scheme and other governmental subsidies for implementation of energy efficiency make ESCO investments easier and more profitable than it would be on a fully market basis.

Therefore a continuous growth is expected still in the public sector, which is foreseen to remain the main client.

[26] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

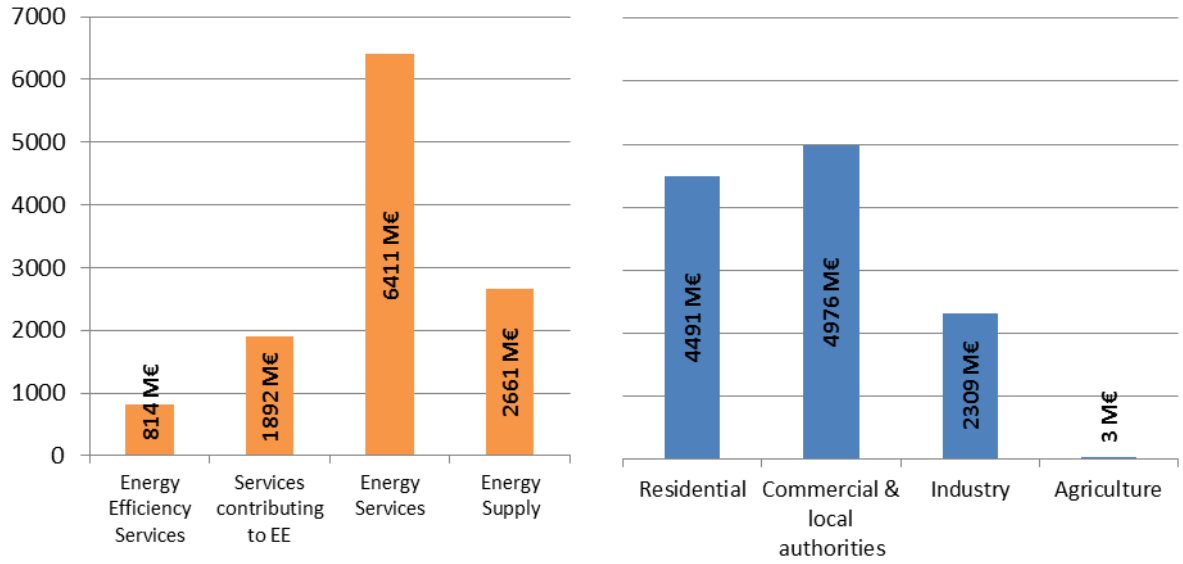
4.10 France

4.10.1 Snapshot of the overall ESCO market

The French ESCO market is known to be **large and growing at** a considerable rate (Bertoldi, et al., 2014).

As of 2016, it features great diversity and heterogeneity. The value of the energy and energy efficiency services largely outweigh that of the engineering and consulting services and of the real estate analysis services (ADEME-CODA STRATEGIES, 2014).

Figure 18 - The size of the energy and energy efficiency service market in France in the year 2013



Source: ADEME-CODA STRATEGIES (2014)

The total number of ESCO-type companies in France is around 350, with **only around 10 EPC providers** offering guaranteed agreements (JRC 2016)).

It is important to note that EPC has a different definition in France than in other EU MSs. The Laws, referred to as **Grenelle 1 and 2 include a definition of EPC**, however it is in line with the French regulation that **forbids the payment for the investments from the savings when the customer is a public customer**. The **only way to use savings to pay investments is a PFI project (PPP in France)** but there are **only few projects each year**.

4.10.2 Market status of EPC in the public sector

The **traditional target** sector of ESCOs in France has been the **public building sector**. However, EPC is **equally popular amongst public and private clients**.

It is common to carry out EPCs in **public buildings, swimming pools, and street lighting.**

The **White Certificates scheme** (Energy efficiency certification system) encourages the development of EPCs in the public sector.

Article 5 of the Decree No2009-967 of 3 August 2009 has amended the law regulating public procurement in order to enable the implementation of EPCs. In March 2010, the Mission Supporting Public-Private Partnerships (MAPPP) published within the context of the renovation of public buildings, a **contract model adapting the EPC to the partnership agreement modalities**. In July 2010, the Ministry of Energy published a

guide to energy performance contracts relative to public works in order to provide guidance to public bodies wishing to use EPCs to achieve energy savings.

4.10.2.1 Project duration and financing

EPC projects can be grouped into two categories based on their length of contract. Projects with a public customer range between **8 and 15 yrs without financial services**, while projects **with financial services usually last more than 20 years**.

4.10.3 Barriers to EPC in the public sector

A number of barriers continue to hamper the expansion of the energy efficiency services market in France (Ministry of Ecology, Sustainable Development and Energy, 2014, JRC 2016).

- - Users, clients and investors are faced with the **complexity** of certain markets or contracts, which results in a **lack of understanding, thus lack of trust**.
- - The **short-term return** on investment in certain cases, in particular for extensive investments and associated services **is difficult to demonstrate**.
- - **Clarifications on the conditions of energy performance guarantees** are also required to support the uptake of EPCs on the market (ADEME-CODA STRATEGIES, 2014).
- - The central barrier is still that the current **Procurement law prohibits channelled energy costs savings** (i.e. costs savings cannot be used to repay the investments)

The development of the EPC market is negatively impacted by the difficulty those public authorities encounter in dealing with the juridical terms of such contracts, as well as by the general asymmetry of information and technical competencies between contractors and services providers.

4.10.3.1 Limitations because of compilation of public debt[27]

The consideration of EPC as public debt **does not seem to be a problem** in France.

4.10.4 Outlook

According to a study commissioned by ADEME, the "energy efficiency service" accounts today for only a limited part of the whole ESCO market and it is therefore essential to support a value transfer from energy services towards energy efficiency services (ADEME-CODA STRATEGIES, 2014).

4.11 Germany

4.11.1 Snapshot of the overall ESCO market

The German **market for energy services is considered as the biggest and most developed** market in Europe, with a tradition spanning more than 20 years. Although in this context, the German EPC market is quite small, however still one of the largest across Europe.

While there are over 500-600 ESCOs, only **approximately 10-15 of them are large EPC providers**, with 2-30 companies following EPC model among others (JRC 2016). Only **7 of them are found to enter tenders regularly**, the others appear occasionally (JRC 2016).

[27] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.11.2 Market status of EPC in the public sector

Although the German market for energy services is one of the most developed in Europe, the **share of EPCs[28] is about 15% of the total contracts for energy service**s. Contracts are realised both in the **public sector, and more specifically in the central and local government** (Busch & Lagunes Diaz, 2013), as well as in the private sector, with the previous one having a slightly larger share (JRC 2016). There are around 30 new projects launched per year of which **17 projects were public tenders last year** (JRC 2016). This is a slight decline from around 40 projects per year in the period 2011-2013. It is a result of small market instability, whereas a few large EPC providers have left the market lately.

EPCs are usually carried out in **public office buildings, schools, educational sites, public hospitals, and street lighting** (JRC 2016).

4.11.2.1 Project duration and financing

The typical length of public EPC projects average **at 12-15 years**, however there are shorter (mainly public lighting) and longer (complex renovation) projects (JRC 2016). This is compared to an average length of 9-10 years in the private sector.

The **minimum** energy cost baseline for EPC has been set at **approx. €200,000** and small, individual public buildings are therefore not considered suitable for EPC projects unless they are taken in account **only in a pool of larger public buildings**. The average EPC project volume in the public sector is between € 200,000- 1,000,000, and may be even larger than €5 million.

ESCOs can therefore fund projects either through their own equity (very difficult especially for smaller ESCOs), or through loans from financial institutions. In Germany, credit with forfaiting is the most commonly used model for financing of EPC projects by ESCOs. In this arrangement, ESCOs sell one part of their future receivables (from client) to financial or credit institutions.

4.11.3 Barriers to EPC in the public sector

The barriers to EPC in the public sector are still numerous, but mostly focussed on the **limitations of tendering**. EPC projects are **seen too complex for the public administration** and therefore already pose a difficulty in defining a proper and correct tender. EPC providers have to make **extra efforts to convince the potential clients** about the benefits of EPC and the trustfulness of the concept. The EPC models used usually include an **opt-out option for clients**, which makes the preparatory phase **risky for the providers** (JRC 2016).

It has been suggested by the experts that the more EPC projects would be implemented, if there was a mandatory step to check the possibility / viability of energy services in the planning of modernisation measures in the public sector (e.g. via a procurement guideline). While EPC is not always appropriate, this could highlight the possibility for the public administrators (JRC 2016).

Financing of EPC projects is not a problem in general, nevertheless **State Budget Regulations are considered too strict** on third party financing (see also chapter 4.11.3.1).

4.11.3.1 Limitations because of compilation of public debt[29]

The ESA 2010 regulations limit the German EPC market only in some federal states. Even before the EUROSTAT guidance note, only a few federal states were affected, **because most municipalities have a high tolerance towards indebtedness** (Szomolanyiova et al. 2015), and because many EPC projects apply a **non-traditional financing method** (e.g.

[28] In Germany is often used ESC (Energiespar Contracting) as the abbreviation for EPC
[29] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

forfeiting), and therefore municipal liquidity and debt issues are not affected by these EPC projects (JRC 2016).

Municipalities have separated budgets and can reallocate the energy cost savings from the energy budget to any other budget. This is not considered revenue but as a simple budget reallocation (Szomolanyiova et al. 2015).

4.11.4 Outlook

The expectations clearly show a growth of the EPC sector in Germany, although with varying degree in different Federal States. A more precise projection is available. It is expected that the EPC market will grow 7% annually on average. In particular, the market for EPC in the public sector as well as the market in hospitals is expected to grow by 10% annually (Busch & Lagunes Diaz, 2013).

4.12 Greece

4.12.1 Snapshot of the overall ESCO market

The ESCO market in Greece remains **negligible**. In recent years, various policy developments have been put in place, addressing some important barriers, but the ESCO market is still stagnant, with very few projects being implemented.

The national ESCO registry[30] contains data for 47 ESCOs, of which **only one is confirmed as an EPC provider** (JRC 2016).

4.12.2 Market status of EPC in the public sector

In 2012 the Ministry of Environment, Energy & Climate Change launched a **pilot programme** targeting the implementation of 5 ESCO projects in public sector buildings based on the EPC model. The total budget was € 589,713 (funded by the Business Programme Environment & Sustainable Development 2007-2013), with an investment budget of € 3.4 million. The Centre for Renewable Energy Sources and Saving (CRES) had the role of facilitator (between ESCOs and public bodies), helping them to overcome possible administrative barriers, providing technical consulting when needed and acting as a liaison and monitoring body throughout the implementation of the projects.

As of 2016, only **one company is confirmed as EPC provider**, although probably others have the capacity for these offerings.

The few projects that have taken place related to **municipal street lighting and public hospitals**.

4.12.2.1 Project duration and financing

The size of the above mentioned projects by the only one EPC provider was very small, **below €200,000**, making up a market volume of less than few million EUR. The length of the contracts is very short, between 2 and 3 years (JRC 2016).

4.12.3 Barriers to EPC in the public sector

The EPC market is only a small portion of the ESCO market, both of which are in preliminary phase.

There is a major problem with the **lack of awareness and confidence** in the energy services in general and in EPC in particular, in all client sectors, e.g. in the public sector.

Furthermore, **financial-related obstacles** constitute one of the most important hurdles in the Greek context. The financial crisis has severely impacted the financial capacity of banks, prospective clients and ESCOs. Potential clients are hesitant to allocate resources

[30] www.escoregistry.gr, participation is voluntary and the reported activity is not verified

for investments on energy efficiency projects, while most ESCOs have a small capital base and have difficulties accessing project funding from commercial financial institutions (Konstantinou & Atzamidis, 2013). The need to **cut expenses** has also severed the ability of the public sector to get actively involved and the **overall market uncertainty** prevents the realisation of large-scale investments.

4.12.3.1 Limitations because of compilation of public debt[31]

It is not clear whether the ESA 2010 definition of public debt and the understanding of EPC as part of that debt affects the Greek EPC sector. There are many other and more important barriers, so most probably the public debt definition does not pose a bottleneck just yet.

4.12.4 Outlook

The financial uncertainty in Greece has created unfavourable conditions for the growth of the ESCO market in the country, and for energy efficiency in general. Despite expressed interest and recent legislative improvements, the market remains undeveloped with limited experience. Some pilot programmes in the public sector and support measures for the services sector are expected to provide a push. Increasing the dissemination of information about energy-efficiency projects and services offered by ESCOs will also advance the understanding of the way ESCOs offer their services and the benefits arising from EPCs.

4.13 Hungary

4.13.1 Snapshot of the overall ESCO market

The Hungarian ESCO market has gone through significant fluctuations between 2000 and 2015, and as of 2016 there seems to be a new halt to the EPC markets.

4.13.2 Market status of EPC in the public sector

EPC used to be a well-established model up to 2010, however it is almost non-existent in 2016. There was a major street lighting project in the summer of 2016, which is probably the only one implemented in the last year.

Due to the very low number of projects in total it is difficult to estimate the number of companies that are actually involved in Energy Performance Contracting in Hungary as of 2016 because many more would be interested to sell energy services than the number that actually can. In 2013 around 6-7 companies were identified that were able to offer EPC (Boza-Kiss & Vadovics, 2013), and this has not changed significantly, but their success rate has started decreasing in the public sector, redirecting themselves towards private projects (JRC 2016).

4.13.2.1 Project duration and financing

EPC projects in the public sector have a contract length of an **average of 5-10 years**, even though the investments are small, up to **maximum €500.000 per project** (Boza-Kiss and Vadovics 2013, JRC 2016).

4.13.3 Barriers to EPC in the public sector

A major drawback of the EPC market in the public sector is the **expectations for grants**. The government stopped energy renovation grants in 2011, which had been often combined with ESCO solutions before. Then, new grants should have been made available but the dates were repeatedly postponed. According to the 2015 (3rd) National Energy Efficiency Action Plan (NEEAP), the government still plans to offer grants (Ministry

[31] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

of National Development of Hungary, 2015) for the public sector that can be used in combination with an ESCO project. Thus the expectations are high, and ESCO projects are prepared, but only rarely realised at the moment. With the growing availability of the new grants, and clear requirements, it is possible that the ESCO solution can be combined again.

Another barrier is that **procurement of an ESCO project is very difficult**. The client is suspicious, comparison of offers, but even the formulation of a tender documentation is not backed up with in-house expertise, and then the bookkeeping is complicated or ambiguous. The **overall and transaction costs increase** due to the extra investment needed, and solutions give rise to possible corruption, and reduce transparency and trust.

Furthermore, the financial restriction where EPC is considered part of it is also a major problem.

4.13.3.1 Limitations because of compilation of public debt[32]

No information available.

4.13.4 Outlook

The future of the Hungarian EPC market in the public sector is unclear at the moment. The market is clearly supply driven, besides the active ESCOs, there are at least 5-10 more companies that are interested in entering this market. However, demand is very low, due to the limited trust and because the ESCOs have to promote the concept themselves, which makes transaction costs high, too.

4.14 Ireland

4.14.1 Snapshot of the overall ESCO market

The market for Energy Services Companies (ESCOs) in Ireland is **still preliminary**. The extent of the **EPC market is not well documented**, and it is **unclear how many (if any) EPC providers** there are in Ireland.

4.14.2 Market status of EPC in the public sector

It is currently unknown to what extent EPCs are currently used on the market, and in particular in the public sector. Energy performance contracting has been identified as a potential means for enabling energy efficiency projects and has, thus, **been chosen as the key initiative to drive the public and commercial energy efficient market.**

The Irish authorities strongly support the establishment/development of EPC with a **complex set of measures**[33]. The leading line is set by the Energy Policy Green Paper of May 12th 2014 published by the Irish government. This is in parallel to the White Paper: Delivering a Sustainable Energy Future for Ireland - the Energy Policy Framework for 2007-2020, recognising the need for government to lead by example. As part of the package, a commitment was made to achieve a 33% reduction in public sector energy use by 2020. With this ambitious target and the associated capital investment required, Energy Performance Contracting (EPC) was seen as a good vehicle to support the public sector deliver in this task while also addressing some obligations under the Energy Efficiency Directive. Accordingly, the Irish authorities developed the National Energy Services Framework in 2013. However, its results are not yet seen.

Pilot projects in street lighting have been carried out, but no information is available about other sectors.

[32] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.
[33] http://www.transparense.eu/eu/news/epc-ireland

4.14.2.1 Project duration and financing

There is no information available about the features of the EPC projects in the public sector. However, based on a few street lighting projects, a typical contract time is between 7 and 12 years (Streetlight-EPC project 2015).

4.14.3 Barriers to EPC in the public sector

There is not enough information available about the features of the EPC projects in the public sector.

One key barrier[34] specific to public lighting EPC projects was found to be the lack of sub-metering, which makes preparing the baseline impossible and the project risky for the EPC provider and difficult to monitor for the client (Streetlight-EPC project 2015).

4.14.3.1 Limitations because of compilation of public debt[35]

There is no information available about the features of the EPC projects in the public sector.

4.14.4 Outlook

There is no information available about the features of the EPC projects in the public sector.

There is no information available about the features of the EPC projects in the public sector.

4.15 Italy

4.15.1 Snapshot of the overall ESCO market

The ESCO market in Italy is still considered to be among the **biggest and most developed** ones in Europe, although the market has been developing in an uneven pattern (Mattedi, 2015). Only about 20 EPC providers exit in Italy, of which about **4-5 are active** (JRC 2016) and have the technical and financial capabilities to provide and sustain a long-term EPC contract (Piantoni 2014), nevertheless Italy has seen a growth in the number of EPC projects and volume of EPC market between 2010 and 2016 (Mattedi 2015, JRC 2016).

4.15.2 Market status of EPC in the public sector

The public sector in Italy is less open and less capable to engage in ESCO contracts than in other countries, because this sector is characterised by a lot of barriers. Nevertheless, EPC projects are found in **both the private and public sectors** (Transparense 2015). Most common targets in the public sector are **schools, educational sites, street lighting, and public hospitals**.

EPC projects in Italy focus on **energy efficiency improvement**, but **often involve additional (e.g. quality improvement) measures**. Typical energy savings are below 30% of the baseline energy consumption (mostly between 5 and 15%).

4.15.2.1 Project duration and financing

The most common overall investment value is between **€200,000 and €500,000**, but can be also much **higher (up to €1 million)**, and occasionally **lower (below €200,000)**. The length of public sector projects is around **8-9 years**, as opposed to 4-5 years in industry (JRC 2016).

[34] This is one of many barriers, but others were not explicitly found in the literature.
[35] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.15.3 Barriers to EPC in the public sector

The key barriers specific for the public sector are the following. The **demand is very limited**, because public authorities rarely know about the possibility of an EPC at all, and therefore **no tenders are announced** even in cases, where EPC would be appropriate. There is a lack of knowledge and awareness of the concept in general.

This is engraved by a **lack of confidence and awareness** about the risks and benefits of EPC, so even those municipalities or public authorities that know about it are reluctant to consider EPC as a renovation/improvement concept.

Regulatory and decision making instability is one key barrier to the overall EPC market, but especially in the public sector (JRC 2016). **EPC providers prefer other types of clients** (e.g. industry), because of the risk of non-payment by the public clients.

4.15.3.1 Limitations because of compilation of public debt[36]

The authors of this report could not find evidence for the impact of the ESA 2010 rules.

4.15.4 Outlook

While the overall ESCO market in Italy is strong and growing steadily, the EPC market is limited although it is growing. However, the success of EPC in the public sector is much hindered by a few key barriers, which would need to be addressed in order to step up this market segment.

4.16 Latvia

4.16.1 Snapshot of the overall ESCO market

The ESCO market in Latvia is still **preliminary** and dependent on subsidies. There **only a few EPC providers in Latvia** (Rochas and Zvaigznītis 2015), even though **EPC is the most common ESCO scheme** implemented (JRC 2016).

4.16.2 Market status of EPC in the public sector

ESCO projects are **very rare in the public sector** in Latvia (e.g. two public building projects started in 2015). Energy services in municipalities are provided by municipal house management authorities (PEKO[37]) public enterprises owned by local governments. PEKO can deal with the maintenance and renovation of public and residential buildings owned by local governments (Government of Latvia, 2014a).

A **few street lighting improvement projects** were implemented before in the Municipality of Tukums using the EPC model. The project was co-financed by the Municipality of Tukums (loan provided by the Nordic Investment Bank) and ESCO company (loan provided by the Latvian Environmental Investment Fund (LEIF) and Latvian Hipotek Bank). The project saved energy of 630 000 kWh with an investment of €395,000.[38].

4.16.2.1 Project duration and financing

There is no information available about the features of the EPC projects in the public sector.

[36] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.
[37] The abbreviation "PEKO" is used to refer to these entities in the Latvian language. For simplicity reasons, the abbreviation PEKO is used hereafter.
[38] Source: http://www.managenergy.net/download/nr22.pdf

4.16.3 Barriers to EPC in the public sector

Although there are few public sector EPCs, they are rare in Latvia because of a number of structural, financial and informational barriers.

In the public sector barriers are related to **public procurement and tendering procedures**. The selection process for the projects in the framework of the "Improvement of heat insulation of social residential buildings" did not include energy savings against investments made. Other observed problem include **the low quality technical project documentations** and issues related to ensuring appropriate procurement procedures (Government of Latvia, 2014a).

Another key identified barrier is **insufficient awareness of energy efficiency benefits** and financial instruments for building renovation including ESCO model and EPC amongst the public sector decision makers. **Trust** issues with regards to ESCOs caused by previous unsuccessful experiences are still seen as a limiting factor (Government of Latvia, 2014a). These result in a **low level of demand**.

Commercial **banks are very reluctant to finance** or co-finance energy services. This is connected with the lack of awareness of the financial benefits on the part of financial institutions.

Finally, **low energy tariffs** for heating are an impediment as heat tariffs are subsided by state. However, studies have showed that the implementation of energy efficiency obligations for district heating suppliers can increase heating tariffs by 5 to 25% (Vancane, 2014).

4.16.3.1 Limitations because of compilation of public debt[39]

Latvian EPC experts **did not quote the ESA 2010 as a limiting factor** in public sector EPC projects. This may be due to the fact that other barriers are more crucial (e.g. lack of information and tendering procedures).

4.16.4 Outlook

The ESCO/EPC market is still at its infancy state in Latvia. While some successful projects in the residential sector have been carried out, EPC in the public sector is not seen as a successful opportunity at the moment.

4.17 Lithuania

4.17.1 Snapshot of the overall ESCO market

The Lithuania energy services market is still **preliminary, with only a few ESCOs active** in the market. There are around 6 companies operating as ESCOs on the Lithuanian market, some of which have been active for more than 15-16 years. Energy supply contracting is the main type of energy contracting in use.

4.17.2 Market status of EPC in the public sector

Energy performance contracts (EPC) are not common in Lithuania, and as of 2016, EPC projects are only in the **pilot phase**. **Three EPC pilot projects** are undergoing public procurement phase and received 3 to 4 tender applications. Based on this and other estimates, there may be around 4-5 companies that have the potential to act as EPC providers in Lithuania.

Between 2014-2016 Lithuania adopted several legal acts, necessary for EPC, including the Program for Improvement of Energy Efficiency in Public Buildings and standard procurement documents.

[39] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.17.2.1 Project duration and financing

The average size of EPC projects that were positively evaluated and approved by the Public Investment Development Agency that issues preferential loans for EPC projects varies between **€200,000€ - 500,000**. The length of the contracts is unknown as they are under preparation.

EPC projects are financed primarily from grants and subsidized loans.

4.17.3 Barriers to EPC in the public sector

Various barriers to the EPC market development have been identified based on Lithuanian NEEAP 2014 (Ministry for Energy, 2014), the JRC survey (JRC 2016) and Transparense project documents (Szomolanyiova et al. 2015):

- Practice of upgrading public buildings (owned by municipalities or the state) through funding received from the **EU Structural Funds** which suppressing the development of energy services in this sector.
- Savings attributable to energy efficiency improvement measures in the public sector **do not remain with the body or organisation but are returned to the state budget**.
- **Complex public procurement procedures**.
- **Limited in-house expertise** to carry out an EPC procurement and latter implementation.
- High risks due to **time-consuming ways decisions at the clients** are adopted.
- **Subsidized prices for heating**.

4.17.3.1 Limitations because of compilation of public debt[40]

The ESA 2010 rules were not indicated as major in Lithuania for the public sector EPC market.

4.17.4 Outlook

The Lithuanian market of energy services is not well developed and the majority of ESCOs on the Lithuanian market act in the district heating sector through ESC-based contracts. Development in the EPC market is not foreseen in current conditions.

4.18 Luxembourg

4.18.1 Snapshot of the overall ESCO market

The ESCO market is generally assumed to be at its developmental phase although each segment within the ESCO market has developed differently in recent years.

4.18.2 Market status of EPC in the public sector

Luxembourgish municipalities have so far been **reluctant to use EPCs**, which could be in part explained by their often small size, as the economic benefits of EPCs can be generally only achieved above a certain energy cost threshold. In order to stimulate the use of EPCs by this segment of the public sector, the **Climate Pact financial aid and Environmental Protection Fund** are made available to them.

The **first pilot EPC-based projects were carried out in mid-2014** in government buildings (NEEAP, 2014). In cooperation with the Public Buildings Administration, myenergy is supporting the pilot projects in order to use the experience gained to further develop the energy services market.

[40] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

A model EPC[41] for the building sector has been developed on behalf of the Ministry of the Economy and in cooperation with the public advisory and information body myenergy.

4.18.2.1 Project duration and financing

There is no information available about the features of the EPC projects in the public sector.

4.18.3 Barriers to EPC in the public sector

There is no information available about the features of the EPC projects in the public sector.

4.18.3.1 Limitations because of compilation of public debt[42]

There is no information available about the features of the EPC projects in the public sector.

4.18.4 Outlook

There is no information available about the future of the EPC market in the public sector.

4.19 Malta

4.19.1 Snapshot of the overall ESCO market

Information about the establishment of ESCOs in Malta is very scarce. Available sources indicate that there are **neither ESCOs nor energy contracts established** in the country (Bertoldi, et al. (2007), Joint Research Centre (2012) ManagEnergy (2013)). This is also confirmed by the Maltese NEEAP 2014 which states that the establishment of energy service companies, as understood in Directive 2009/32/EC, would run contrary to previous derogations granted to Malta (Maltese Authorities, 2014). These include derogations from Chapter IV, Article 20(1) and Article 21(1) of Directive 2003/54/EC in Decision 2006/859/EC, and Articles 26, 32 and 33 of Directive 2009/72/EC.

4.19.2 Market status of EPC in the public sector

There is **no EPC market** in Malta.

4.19.2.1 Project duration and financing

There is **no EPC market** in Malta.

4.19.3 Barriers to EPC in the public sector

There is no EPC market in Malta.

4.19.3.1 Limitations because of compilation of public debt[43]

There is no EPC market in Malta, therefore, the ESA 2010 rules are not relevant for Malta.

4.19.4 Outlook

There seems to be no change foreseen for the EPC market in Malta in the near future.

[41] The model contract is aimed primarily at public buildings and may be downloaded from http://promotiondusecteur.myenergy.lu/, although should be used with care, as it is not fully adopted to local context (it is the model contract developed by the Berlin Energy Agency)

[42] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

[43] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.20 The Netherlands

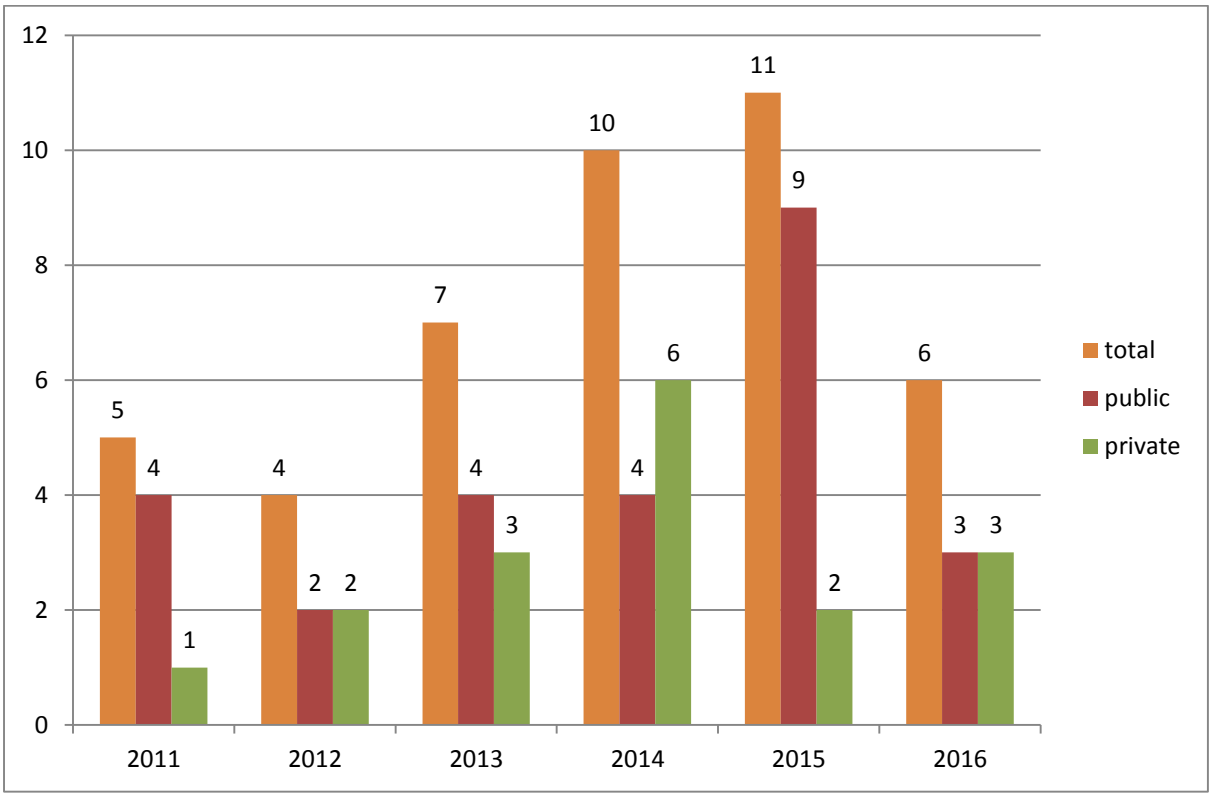
4.20.1 Snapshot of the overall ESCO market

The energy service market in the Netherlands is of **moderate size** and has seen **significant growth** in the last few years. As of 2016, it is estimated that about **25-30 companies offer EPC** (Selina et al. 2016). There are also a good number of facilitators, who seem to be crucial for the ESCO market boom (JRC 2016).

4.20.2 Market status of EPC in the public sector

The **market for EPC has gone through a significant growth between 2013 and 2016**. The number of projects increased drastically. Compared to 16 projects during 2011-2013, there have been 27 projects identified between 2014 and early 2016 (Roskam, Piessens, and Thijssen 2016) (see Figure 19), and there are over 57 projects in the database of Netherland Entrepreneur Agency (RVO).

Figure 19. The number of EPC projects initiated in each year between 2011 and 2016 (2016 is incomplete)



Source: (Roskam, Piessens, and Thijssen 2016)

EPC is popular among public clients, such as municipalities.

Gemeente Rotterdam is a front runner with 3 EPC projects done (swimming pools, Kunsthal and municipal buildings). The national government used EPC contracting for the renovation of the Van Gogh Museum. A school project has been also launched in 2016 in Eindhoven.

Several other projects have been implemented by ESCOs under EPCs in schools (e.g. renovation of 8 elementary schools in Velhoven), care centre facilities, public swimming pool, and commercial buildings. The primary goals of the projects are energy savings, but also the improvement of quality of indoor air conditions in public buildings and facilities is important selling factor. The total number of public clients is growing rapidly.

Out of the top 25 deep energy retrofit projects which are collected by the Netherland Entrepreneur Agency (RVO), 25% are done by an ESCO and there is an EPC underlying.

4.20.2.1 Project duration and financing

In most cases, contracts in the public sector are concluded for **7-10 years** (the shortest duration is 5 years and the longest is 30 years), and they are **small** (up to €200,000 investment volume), but when **bundled**, the project size grows to many-fold.

In the public sector the **BNG bank is a financial service provider** to provide initial costs for the implemented measures. For bigger projects **external financing** is mostly used, either via supplier, or via own credit lines (like BNG in the public sector). The most common way to finance is debt financing, and mostly on-balance. Occasionally and **SPV** is established to carry out the project.

4.20.3 Barriers to EPC in the public sector

The environment is rather **beneficial for the ESCO market in the Netherlands as of 2016**, still there are various barriers that slow down the market.

The municipalities are often **concerned about out-sourcing** their energy management and are reluctant to enter an EPC project. The successful examples that are accumulating are expected to largely relieve this barrier in the near future.

At the same time, those municipalities that plan to enter an EPC project, face **problems with announcing and formulating a tender**, for which they have limited internal capacities. The lack of **standardized contract** for energy services (especially for EPC) and **lack of M&V protocols** increase the risks as well as transaction costs, although non-official model contracts are available.

The **complex decision making structures** and procedures make it challenging to carry though a complex project proposal, as EPC. The time-consuming procedure increases transaction costs.

Competition with other instruments is also one barrier for energy services. PPP as an instrument is often used for buildings renovation. Moreover, energy services are often tendered with other services as maintenance of buildings, even with renovation or construction of new buildings, which makes the projects more complex.

4.20.3.1 Limitations because of compilation of public debt[44]

The consideration of EPC as public debt **is not a problem** in the Netherlands for almost any municipality because there are no liquidity issues.

4.20.4 Outlook

The market for energy services in Netherland has gone through major changes during 2014-2016. It is expected that the EPC market for the public sector will continue to expand.

[44] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.21 Poland

4.21.1 Snapshot of the overall ESCO market

The energy services market in Poland continues to **struggle** to tap the opportunity lying in the very large energy saving potential in almost all end-use sectors, and in spite of the repeated efforts nationally and from IFIs, the market remains **poorly developed**.

4.21.2 Market status of EPC in the public sector

The **energy performance contracting is not common in Poland**. A few large international ESCOs offer services based on the EPC model.

Only a **few (up to 10-20) EPC-related** projects have been undertaken since 2013, although the spread has slightly increased (JRC 2016). These include **both public and private sector projects** (Szomolanyiova et al. 2015). In the public sector **public buildings, schools, educational sites, public hospitals, and street lighting** projects have taken place.

4.21.2.1 Project duration and financing

The length of EPC projects in municipalities is an **average of 10 years**, as opposed to 4-5 years maximum in the private sector (JRC 2016). EPC projects run in the **size of €200,000 to €1,000,000**.

EPC providers often use their own equity to finance projects, or pull down bank loans or lease equipment (JRC 2016).

4.21.3 Barriers to EPC in the public sector

The limited EPC activity on the Polish market can be explained by a variety of reasons. Some of the barriers identified by the experts in Poland are:

- Legal issues related to ESCO contracts: There is a need to improve very **complex public procurement procedures**, which exclusively **focus on economic (lowest price) criteria** and not on energy savings. Furthermore, there is no commonly accepted definition or standard procedures.
- **Regulatory instability** limits the interest in long-term contracts. In particular, tax laws have been changing with major impacts on running projects, sacrificing the profits of EPC projects.
- Public debt and ESCO contracts: EPC contracts are **considered as public debt** accumulated by local authorities.
- **Collision of interest with state funded programmes**: The co-financing provided in the form of grants by the state budget and/or from EU Cohesion Funds for the public l sectors is in a collision with market based EPC. It is not clear what will happen after the completion of these state programmes and funds, and how the ESCO market will be affected.
- **Lack of understanding of the ESCO concept**: The potential clients are not well informed about EPC and the associated benefits of the ESCO concepts.
- **Lack of interest** for energy services on the market: The Polish market can be recognized as a non-demand driven market. There is generally a lack of knowledge of energy efficiency investments and low visibility of ESCO services.
- **Insufficient promotion of ESCO activities**: There is no ESCO association which can play the role of organiser of promotional activities, information campaigns and awareness raising events.

4.21.3.1 Limitations because of compilation of public debt[45]

EPC contracts are considered as public debt accumulated by local authorities. This approach has been long standing and the ESA 2010 or the EUROSTAT guidance note only confirm the procedure.

4.21.4 Outlook

The Polish market has significant potential for energy services in all sectors. However, with the current market conditions and serious barriers to EPC in the public sector, a development is not foreseen in the near future.

4.22 Portugal

4.22.1 Snapshot of the overall ESCO market

The ESCO sector in Portugal went through a **slow, but solid growth** since 2010. In particular, the market for **EPC is getting off the ground recently** (Fonseca, Patrao, Fong, & de Almeida, 2015), providing some pilot projects (Government of Portugal, 2013) besides a few successful market-based companies with a steadily growing investment rate (Ponte pers.com.).

4.22.2 Market status of EPC in the public sector

The market for EPCs is **emerging now**, with a continuous, although very slow increase (Fonseca, Patrao, Fong, & de Almeida, 2015). It is **unknown, how many of the ESCOs can and will supply EPCs**, nevertheless interest is rather high due to the possibility to enter the public building sector market as part of the **ECO.AP programme**.

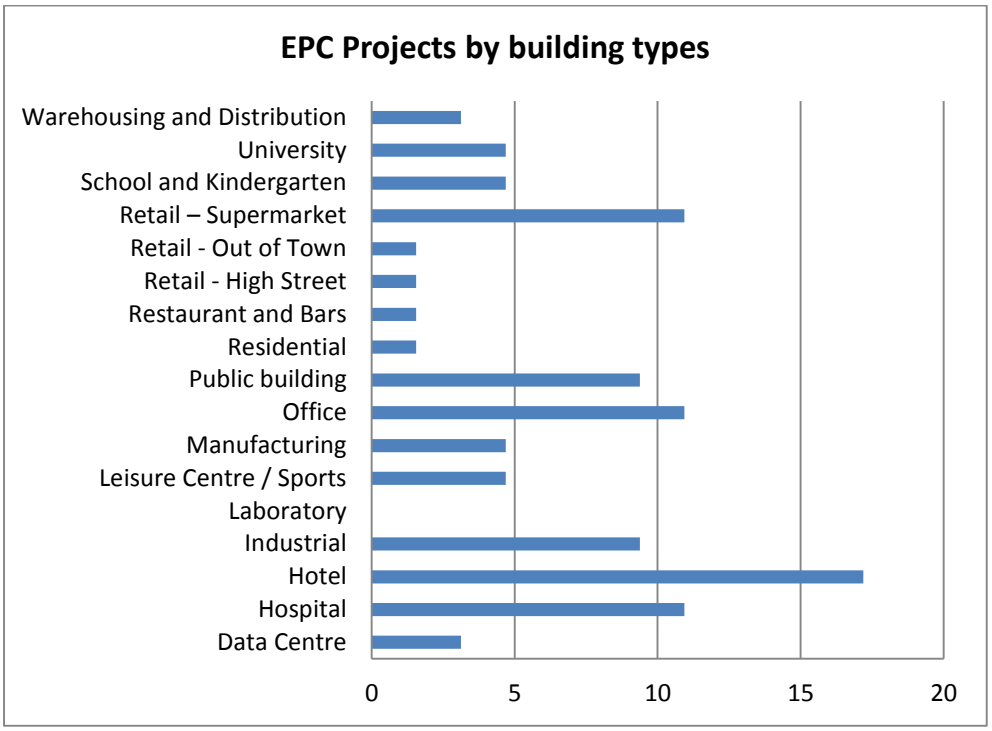
Around **5-10 EPC projects are implemented in a year** (Fonseca, Patrao, Fong, & de Almeida, 2015), however these can be considered as pilot projects generally.

Projects can be found in **hotels, hospitals, leisure centre sports, schools and public buildings, and occasionally with industry**. In particular, the NEEAP expects that the rigorous improvement of energy efficiency of **governmental buildings and public lighting** to be implemented and financed by ESCOs using EPC (Government of Portugal, 2013), however the programme has been lagging behind so far (JRC 2016).

As can be seen in Figure 20, **both public clients and private clients** use EPC, but the EPC market for the public buildings sector runs on a very low scale, and so far the national programmes and funding alternatives have not been fully successful (JRC 2016).

[45] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

Figure 20 - The number of EPC projects by building types between 2010 and 2013



Source: (Fonseca, Patrao, Fong, & de Almeida, 2015)

4.22.2.1 Project duration and financing

EPC projects in general are with a value of between **€100,000 and €500,000 each** (Fonseca, Patrao, Fong, & de Almeida, 2015), and public EPC contracts are as long as **15 years**.

4.22.3 Barriers to EPC in the public sector

While there are many general barriers to energy efficiency and the ESCO market, two of them have been highlighted as specific for the public sector EPC projects.

The procurement of an EPC is a complex process and **in-house capacities are lacking** to do this. However, interlocutors or **facilitators**, who could mediate between the client and the EPC provider is generally **missing**. Although the government identified a local energy manager for each public building and facility, many times they are not trained to understand energy efficiency issues, inter alia EPC.

The **promising ECO.AP programme** that was expected to give a boost to the public EPC market, has proven **to be not too attractive for the moment**. It is especially turned down by EPC providers and the financial sector, mainly because the public contract framework established does not allow the blocking of funds of public entities for paying off the savings and therefore there are no guaranties for ESCOs and banks to receive their investments.

4.22.3.1 Limitations because of compilation of public debt[46]

There is no information available about the impact of the ESA 2010 definition of EPC as a public debt in Portugal.

[46] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.22.4 Outlook

Undoubtedly, the Portuguese government has assumed a strong commitment to energy efficiency and EPC. The legislation behind the ECO.AP programme launched the basis to establish EPC contracts, since it created a structure for new public contracting scheme, defined the architecture of the process and the contract template to be followed by all public institutions. In addition, a qualification framework for ESCOs has been introduced with the ECO.AP.

While expectations were very high related to the ECO.AP programme, and these were not yet met, new efforts are being invested, and the programme may be redesigned in an effective way. There are some important design elements that need to be re-established (Ponte pers.com.). Should this be effective, the EPC market in the public sector may be boosted.

4.23 Romania

4.23.1 Snapshot of the overall ESCO market

The ESCO market, and in particular the EPC sector is **stagnant** in Romania.

4.23.2 Market status of EPC in the public sector

Energy savings potentials in public buildings are still largely untapped. Local governments are **not able to take EPC/ESCO models into consideration**, even when there would be an interest to implement one.

The number of EPC providers in Romania cannot be estimated with confidence. The number of companies that could be able to offer EPC is **below 10**. There have been 10-15 performance-linked ESCO projects that are remunerated only if a certain economy is achieved over a short period of time especially in **public lighting** and industrial processes (JRC 2016).

Galati became the first Romanian local authority to launch a public procurement procedure to contract energy efficiency services for public buildings in May 2015 (Transparense project, 2015; Craiova City, 2015). The project serves as pilot program of the European Bank for Reconstruction and Development (EBRD), funded by the Global Environment Facility (GEF). The EBRD program aimed to rehabilitate a number of public buildings matching the financing with energy performance contracting by ESCOs. The buildings related to this program are Galati's Emergency Hospital for Children "Sf. Ioan", and a group of 5 schools of primary education. EBRD provides free technical assistance to municipalities to prepare energy efficiency projects in public buildings (kindergartens, schools, hospitals). Three more projects were involved in the programme, and following the pilot phase, the program was expected to be extended to other interested municipalities to implement energy efficiency projects in public buildings (Craiova City, 2015). (Dragostin pers.com.) However, for the moment, implementation has been delayed (see later). (JRC 2016).

4.23.2.1 Project duration and financing

The size of EPC projects would revolve in the lower volume segment (up **to €200.000 or €500.000**), with **very short contract periods of 2-3 years**. Normally, the average contract period would be around 10 years, however projects with longer turnover are usually reduced to a shorter financing period and the instalments are delinked from the performance of the project. (JRC 2016)

Financing of EPC projects has been based on **IFI streams**. So far a number of programmes have been used, such as EBRD co-financing, UNDP grants, EU financing programmes, , specific investment funds (BAF - Balkan Accession Fund), which were then combined with the **clients' own sources or EPC providers' own sources**.

4.23.3 Barriers to EPC in the public sector

There are many major barriers in Romania to EPC in the public sector. The most central one at the moment is the ESA 2010 rule on public debt (see in chapter 4.23.3.1).

Although the EPC definition was introduced, the legal landscape remains vague in the moment of practical implementation. The **definition is not reflected in other legal acts**, e.g. PPP Law, Fiscal Code, and Concession Law. For example, the public acquisition laws published recently (L98, L99, L100, L101/2016) do not take into account EPC possibility, only in a covert manner where an EPC can be considered as a best cost - benefit solution. Local Public Administration Finance Law (no. 273/2006, as updated) – doesn't include provisions on investments made by Public Authority under EPC (whether they should be considered on or off-balance sheet).

The legal and procedural frameworks – including a model contract template – are missing. Model contracts could guide the partners through in ambiguous questions, such as changes in assets' destination/ownership and changes in end-consumers behaviour, which may affect the ESCO's cash flows from savings. Also, it would be crucial to help the partners settle the risk distribution between client and ESCO in a well-balanced way.

On top of this, the **electronic system for public acquisitions (SEAP) is not yet adapted** for complex contracts as EPC.

So far, the ESCO market was **dependent on IFI grants**. However, commercial banks are reluctant to assist ESCOs since they have no experience in associated risks management. At the same time, availability and cost of long-term debt to match EPCs with long repayment profiles might be very high, affecting ESCOs cash flows.

There are sometimes problems with the **payment behaviour of the beneficiaries**, and payment guarantees are not well developed. Project preparation is difficult, due to the insufficient and unclear data (especially baseline for consumption). There is a general distrust in different types of solutions (financial, technical, legal) that have not been implemented in Romania.

Although some improvement has been made over the past years, the **procurement process is still too complex**, **ambiguous and time consuming** for the local ESCOs. EPC is not regulated in public procurement contracts which make bids for energy rehabilitation of buildings and / or public street lighting systems non-accountable. Public sector projects are risky due to **insecure decision-making and due to the lack of trust** between client and ESCO (and the bank if third-party financing would be considered).

4.23.3.1 Limitations because of compilation of public debt[47]

The EUROSTAT accounting and its understanding results that EPC projects are added to the value of the government debts, which are on the other hand limited by the EU legislation (Directive 2011/85/EU on requirements for budgetary frameworks of the Member States and related regulations) is a **grave problem at the moment for EPCs in the public sector**. This seriously limits the possibilities to engage with and support EPC at political level. At the moment there is no satisfactory solution for this, but at EU level action is needed.

Furthermore, Government Decision no. 264/2003 sets **strict limits of the actions and expenditure categories, criteria, procedures and limits for payments in advance of public funds** which do not leave room for EPC specific provisions. Services to be provided by ESCOs in the implementation phase of energy efficiency projects could be only considered advance payments, as contribution of Public Authority to the project.

[47] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.23.4 Outlook

Overall, the EPC market, is stagnant, and with the current conditions, no major changes can be expected. While the basic legislation and a number of measures have been put in place to promote the ESCO market, these changes have not been enough to kick-start the market, and there are further major barriers that need to be addressed before a growth can be expected (especially that of the EUROSTAT definition of EPC under public debt).

4.24 Slovakia

4.24.1 Snapshot of the overall ESCO market

The Slovakian EPC market has seen **important growth** in the recent few years, even if it is **still relatively small** in total size.

4.24.2 Market status of EPC in the public sector

During the period 2014-16 **key market conditions have changed**. On one hand the regulatory framework for energy services (Act No 321/2014 Coll. on energy efficiency) has been adopted, bringing through a number of implementing measures, such as definition of EPC, licencing and quality assurance, regular training of EPC providers, as well as a number of informational measures.

The application of EPCs has increased considerably during the period 2014-2016. Although Slovakia had implemented a limited number (about 25) of EPC projects by 2006 as part of a programme in the public building sector (Government of Slovakia, 2014), the EPC concept lost its popularity following some cases of underperformance. Interest was regained when an **18 year-long EPC-based project** (using the guaranteed savings model) **for 74 secondary schools** was initiated in 2012 in the Košice region by a large ESCOs (Bertoldi, et al., 2014).

As of 2016, there are **15-20 EPC providers**, which is a significant growth compared to previous times. Of these, there were about **10 companies that had running projects** during the period. There were **around 40-50 projects** running during the period 2014-2016.

Currently the public sector is not well supplied by EPC. Before 2015, EPC projects were focused almost **exclusively on the public sector**, and most of the projects were done in **street lighting, others in public buildings, schools, educational sites**. However, with the appearance (or even with the promise) of grant financing for reconstructions of street lighting systems in 2015 and for public buildings, the development and realization of EPC projects in this sector were stopped, and rechannelled to the grant scheme.

As a result **EPC providers shifted their focus to the private sector**.

4.24.2.1 Project duration and financing

The size of projects varies between rather small (up to €200,000) and mid-sized (€500,000 - €1,000,000), with contract lengths of **10 years** in public sector, as opposed to 3 years in private sector (JRC 2016).

The most common combination of financing of EPC projects comprises of the **own resources of the EPC provider and resources from financial institution** (loan taken by the EPC provider). Occasionally, financing also involves the own resources of the client.

4.24.3 Barriers to EPC in the public sector

As mentioned above, the absolute halt to public sector projects is caused by the **competition with public grants** or their promise.

Furthermore, the economics of a project is questioned due to the obs**olete technical state of public buildings,** meaning that public buildings are in a serious need for complex refurbishment, not only in the energy performance, but also in state and security. This increases additional costs.

On the clients' side, the basic principles of ESCO projects and the benefits of energy efficiency investments are understood quite well, however there is a **lack of knowledge about the details of contracts and their preparation**, which forms a key barrier in trusting ESCO projects. The potential clients do not distinct among different types of ESCO services.

Finally, the ESA 2010 rules to include EPC in public debt is also a major obstacle (see below).

4.24.3.1 Limitations because of compilation of public debt[48]

As the result of the ESA 2010 rule, **municipalities are now restricted from using EPC**, particularly those that are near the debt limit defined in budgetary rules. Public decision makers are reluctant to consider EPC as a way to implement energy efficiency investments. Thus, instead of complex solutions with guarantees, they implement partial solutions (most of which in emergency conditions) or implement complex projects financed from grants (mostly ESIF) without guaranteed savings. (Litiu et al. 2016, JRC 2016).

4.24.4 Outlook

While the EPC market is flourishing in Slovakia, it has redirected from the public sector, even if it is in great need of receiving private funding contributions. Unless the public debt issues and the competition with ESIFs is resolved, the wide-scale refurbishment of public buildings is financed from public money only, and/or not to an extent needed.

4.25 Slovenia

4.25.1 Snapshot of the overall ESCO market

The Slovenian ESCO market kicked-off in 2001 (Staničić, 2013), and was growing steadily, with EPC projects entering the market in 2007 (Staničić, 2013), however – as of 2015 – it is still poorly developed and has immense space for further growth (Ministry of Infrastructure of Slovenia, 2015).

4.25.2 Market status of EPC in the public sector

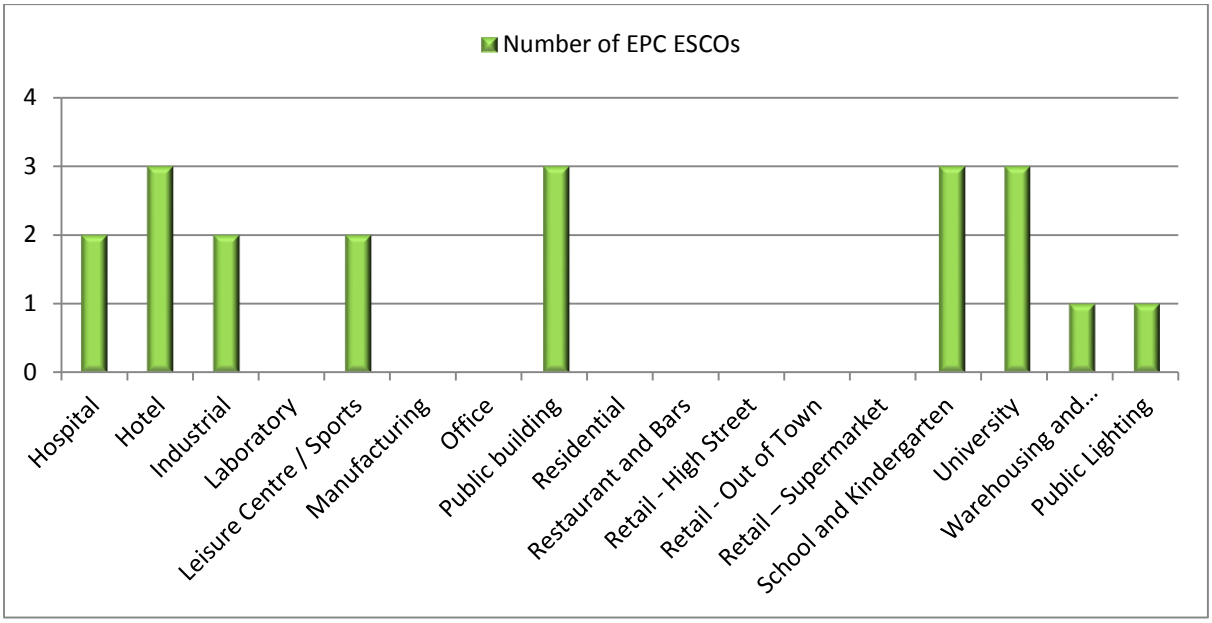
As of 2016, there are between 4 and 6 EPC providers in the country, in line with earlier findings (Staničić, 2013, Staničić, 2015, Staničić pers.com.)

The number of **EPC projects has risen sharply**, from an average of two new projects per year to more than 15 in 2013 (Staničić, 2015), which continues in a similar way in 2016 (JRC 2016). This is also reflected in a change in the market structure. While the value of EPC projects represented around 10% of the total market activity before 2013, with the introduction of the energy efficiency obligation scheme (EEO), it has increased to 40% (Staničić, 2015). However, the scheme was changed (see below), (Staničić pers.com.), but the market operation was kept based on the improved regulatory and soft measures. The expected financing leverage is foreseen from the Operational Programmes that could continue the support for the EPC market.

[48] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

The first ESC projects took place in the public sector (in 2001) and the ESCO market is progressing in this area the most. The known EPC projects are distributed among sub-sectors as shown in Figure 21. As can be seen, **14 out of 20 projects are public projects**.

Figure 21 - Distribution of EPC projects



Source: (Staničić, 2013)

4.25.2.1 Project duration and financing

The average duration of a project is **10-15 years**, with moderate sizes of **€200 000-€500 000**.

The projects are financed from the EPC providers' own resources, which can be eased by the past and future national grants. The investments remain on-balance sheet (JRC 2016).

4.25.3 Barriers to EPC in the public sector

EPC projects in the public sector are performed in the framework of the Public Private Partnership Act and in line with Public Procurement Act, both introducing additional **complexity** into an already complex EPC implementation process (baseline, auditing, tendering, guarantees, monitoring and verification of savings) and consequently increasing costs. (Staničić, 2015).

In this context, public authorities **lack trained personnel** at all stages of EPC project development and implementation. Furthermore, there is also a **lack of qualified EPC facilitators** that could assist public authorities to overcome this barrier. There is also evident **distrust and fear** towards the actual applicability and effectiveness of the EPC mechanism.

The **supply side of the ESCO market is still very small**, and this limits the size of the market. The economic and technical risk are still too high in relation to the determination, monitoring and verification of energy performance guarantees in public buildings for both the ESCO and public building owner, and this is a major barrier to the broader expansion of ESCO model uptake (Vajdić & Gluščević, 2015)

4.25.3.1 Limitations because of compilation of public debt[49]

Public authorities are also limited due to the **existing indebtedness or caps on new public debt**. The assets underlying an EPC contract to provide energy efficiency services on the basis of dedicated assets are often considered to be on the public sector balance sheet and not on the private sector balance sheet (Staničić, 2015).

With the interpretation of the ESA 2010 rules, EPC projects contribute to the public debt level, and therefore there is a limitation to the size and number of running projects.

4.25.4 Outlook

It is expected that **further market growth** will be seen and this will be mainly linked to the renovation of public buildings, where some of the tenders are already announced and projects are in the pipeline. The basis for intervention in public buildings lies with the fact that this sector experiences under-investment in particular in heating, lighting, ventilation and air-conditioning, leaving a niche for EPC projects. This is combined with the obligatory yearly renovation rate of governmental buildings, which translates to 1.8 million m2 of useful area in the public sector to be refurbished by the end of 2023 (Staničić pers.com.).

4.26 Spain

4.26.1 Snapshot of the overall ESCO market

The Spanish energy services market has been long awaited to boom. This is also due to the complex set of governmental support programmes firstly introduced and later stopped. In spite of the still missing national programmes, the **ESCO activities have increased in both public administrations and new private sector business niches**.

4.26.2 Market status of EPC in the public sector

It is even more **difficult to find precise figures in relation to EPC**. It is generally known that EPC-based projects are mainly used in the private sector and that the shared savings model is preferred to the guaranteed savings one (IDAE 2011; EC JRC 2012). **In recent years, some EPCs were developed for local authorities** (JRC 2016).

The key target of EPC projects has been **public lighting** (including a large project European streetlighting project that support municipalities to carry out improvements with EPC). Furthermore, there are a few projects for **public buildings, public hospitals, and schools/educational buildings**.

4.26.2.1 Project duration and financing

The length of public sector EPC projects is **under 10 years** (as opposed to 10-12 year contracts in the private sector).

4.26.3 Barriers to EPC in the public sector

The precise reasons for not developing an extensive EPC market are not well documented. There are some general ESCO barriers identified, in particular the lack of trust in the concept, due to a low level of awareness and difficulties in procuring complex projects, such as EPCs.

However, the central barrier in the public sector has been named to be the financial constraints due to the ESA 2010 rules (see below).

[49] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.26.3.1 Limitations because of compilation of public debt[50]

The current interpretation of International Financial Reporting Standards (IFRS), confirmed by the 2015 EUROSTAT guidance note, makes it difficult to engage in EPC projects. This is because these investments, despite being delivered and financed wholly or in part by private sector partners, require capital budget to cover their cost and as a result are recorded as being on balance sheet and counted towards public sector debt.

4.26.4 Outlook

The EPC market, especially in the public sector is not well known. It is clear that a few key barriers hinder an expected level of development, which were foreseen to be overcome with the number of national wide programmes, but they were cancelled. With the current conditions, further development is halted.

4.27 Sweden

4.27.1 Snapshot of the overall ESCO market

The energy services market in Sweden can be described as moderately sized or even preliminary in terms of energy performance contracting, dropping from a rather well developed status. As of 2016, **only 3 EPC providers are active**, **with 2-3 more ready for EPC projects**.

4.27.2 Market status of EPC in the public sector

The **main client for EPCs is the public sector** including **administrative office buildings, schools, hospitals and healthcare centres**. According to some experts, currently all the projects are in the public sector.

The number of **newly implemented EPC projects** has been **around 5-8 during the period 2014-2016**, whereas the total number of concluded EPCs was around 100 in the early 2000s (Swedish authorities, 2014). The **number of projects has been decreasing** for some years, and there have been a few projects that had to be terminated before completion, and these raise bad reputation for the sector.

The most used model is a combination of guaranteed savings and the two-step model. The latter assumes a smaller risk for the ESCOs compared to one-step model (Wargert, 2011). EPCs have been **transformed from a technology-focused solution to a cost-based model**. There is no standard contract model for EPCs in Sweden and each ESCO offers a slightly varied type of contract (Gode, 2013).

Most implemented measures through EPCs are **building energy management systems, improvement of heating, ventilation and air conditioning systems and lighting controls**.

4.27.2.1 Project duration and financing

EPCs (almost all in the public sector) last on average between **5-10 years**, and yield energy savings of around 16-30%. The value of the undertaken EPCs is estimated to be around **€1-5 million** per contract (Gode, 2013, JRC 2016).

4.27.3 Barriers to EPC in the public sector

Public sector specific barriers include the following:

- **Lack of in-house competence** to properly specify the contents of an EPC project/tender by potential clients,

[50] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

- **Trust** issues between ESCOs and purchasing parties, therefore a fear of procurement and concerns about getting locked-up with an unwanted contractor,
- The above is based on the **few previous bad experiences**, which resulted in the termination of projects,
- Clients **prefer in-house solution**, perceiving this as a more cost-effective way to do the same implementation,
- Considering an **EPC as expensive**: perceiving no added value of doing EPC.

4.27.3.1 Limitations because of compilation of public debt[51]

The ESA 2010 rules do not have an impact on the public sector EPC market because the level of public debt is low, and there is space to admit EPC projects in any kind of book-keeping.

4.27.4 Outlook

The EPC market in Sweden was regarded as a well-developed market in the past, which has lost momentum in recent years, and experienced a new shift towards ESC activities. Growth of energy prices and readiness of Swedish government to reduce CO2 emissions through usage of more environmental friendly technologies and renewables, shall lead to further market expansion. But it is not yet clear if this expansion will affect the ESC or the EPC segment, and which client sector will benefit most.

4.28 The UK

4.28.1 Snapshot of the overall ESCO market

The UK energy services market is a growing and competitive market, largely due to the government's commitment to support its on-going development as part of the implementation of the UK Energy Efficiency Strategy. Financial facilities and programmes such as Salix and public programmes, such as RE:FIT and CEF in the public sector have contributed towards the positive environment within the market.

4.28.2 Market status of EPC in the public sector

The **use of EPCs is at a rising trend** in the UK with a number of successful completed energy efficiency projects in public sector organisations and more projects planned for future implementation. EPCs have been carried out across **wide range of public buildings and different sectors including local authorities, the NHS, schools, further education and universities** (Department of Energy & Climate Change, 2015).

It is estimated that there are between 20 and 25 companies that offer EPCs in some form and 22 were participating in the public procurement frameworks. These organisations are typically multinational companies, and not UK specific.

It is estimated that there have been around **100 new projects between 2014 and 2016**. This represents a major growth of the market. The projects are mostly contracted with public buildings, schools, public hospitals, leisure facilities.

4.28.2.1 Project duration and financing

Contract lengths vary from a minimum of 3 years to a maximum of 25 years, although most are between 5 and 10 years. Energy savings are typically between 10 and 30% of baseline and typically involve capital investments of £0.5–5 million on average (ca. €0.6-6 million) (Nolden and Sorrell 2016).

[51] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

4.28.3 Barriers to EPC in the public sector

The UK Energy Efficiency Strategy identified the key barriers to the deployment of cost effective energy efficiency investments. These are complemented by barriers identified in the JRC 2016 survey process specific for the public sector (Department of Energy & Climate Change, 2014, JRC 2016):

- Lack of Information: Accessing trusted and appropriate energy efficiency information has often proven difficult. Where information is available it is usually generic and not tailored to specific circumstances; or it is focused on particular opportunities, meaning that individuals and businesses are unable to fully assess the benefits of the energy efficiency opportunity.
- Undervaluing energy efficiency: The long term financial and wider benefits of improved energy efficiency are often regarded as less certain, partly because of the lack of trusted information in the market. Consequently, energy efficiency has traditionally been undervalued relative to other investment options and not prioritised as it might otherwise be.
- Lack of capacity and skills to deliver EPC and to contract EPC by clients. Clients could be helped on all terms of an EPC contract, such as procurement, legal, commercial, technical and project management level.

4.28.3.1 Limitations because of compilation of public debt[52]

The ESA 2010 rule has not special impact on the UK EPC market, partially because there are no major debt issues at municipalities, and because the tailored programmes overcome this and other potential barriers.

4.28.4 Outlook

After the financial crisis of 2008, when the ESCO sector halted in the UK, there is a significant increase since 2012. The UK Government has been particularly supportive of the ESCO market development. As a result, an increase in the number of realised EPCs has been observed and programmes such as RE:FIT have seen great success in the past few years.

[52] Based on http://www.transparense.eu/eu/epc-qa/financial-issues with updates from JRC interviews.

5 Conclusions

The public sector is a key energy consumer in Europe. Buildings owned and/or managed by the public sector make up more than 10% of the overall EU building stock. In absolute terms, public buildings and associated installations represent a significant, largely untapped potential for energy savings. Very often public buildings also need maintenance, refurbishment and have a low efficiency. In spite of the potential, public sector proceeds slowly in improving energy efficiency due to a number of barriers, including limited financial resources and/or limited creditworthiness, limited human resources in numbers and in profession, split incentives, etc. Yet the sector is an excellent target for Energy Performance Contracting (EPC), because EPC brings in private funds for financing a public project, while it may be a cheaper solution than in-house project management potentially resulting in a complex renovation package. EPC involves the transfer of technical and often financial risk, offering a professional project management service.

The picture of the current status of using EPC in the public sector is very diverse. There are only a few countries, where a well-developed EPC market could be identified in the public sector (DK, DE, UK), and several which are well advanced (FI, CZ, NL). France is special case, with a moderately advanced EPC market in the public sector, because the EPC definition actually misses the core EPC value, i.e. repayment from the savings, as a result of the French legislation.

To complement the market review, we estimated the potential energy savings and investment cost needs. The economic final energy demand savings potentials are around 34 and 58,5 TWh in the public buildings of EU Member States, in building larger than 1000 and 500 m^2 respectively, with economic savings of a total of 2,7 – 5 Billions of Euro, that would mean a need for total investments of 21,3 – 39,4 Billions of Euro is needed. This total amount can be translated in an average renovation cost per building of about 27 000€ and an average cost per square meter of around 17,5 €/m^2.

We also explored the outlook for the EPC market in the public sector through the survey. Most of the markets are expected to grow in the near future, even those that are still in a preliminary phase. This may be overly optimistic though, especially considering that some of the barriers identified (in particular the ESA 2010 definition) are a major bottleneck (in RO, SK, SI, CZ, SE, ES, PT, PL, etc.).

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List of abbreviations and definitions

AT - Austria

b - billion

BE - Belgium

BG - Bulgaria

CHP – Combined heat and power

CO_2 – carbon dioxide

CR - Croatia

CY - Cyprus

CZ- Czech Republic

DE - Germany

DK – Denmark

EBRD - European Bank for Reconstruction and Development

EC – European Commission

EE – Estonia

EED – Energy Efficiency Directive, Directive 2012/27/EU

EEO or EEOS – Energy Efficiency Obligation Scheme

EESI2020 – European Energy Service Initiative towards the EU 2020 energy saving targets

ES – Spain

ESD – Energy Services Directive, Directive 2006/32/EC

EPC – Energy Performance Contract

ESC – Energy Service Contract/Energy Supply Contracting

ESCO – Energy service company

EU – European Union

EUROSTAT - statistical office of the European Union

EVO – Efficiency Valuation Organisation

FI - Finland

FR – France

GR - Greece

H2020 –Horizon 2020

HU – Hungary

IE - Ireland

IT - Italy

JRC – Joint Research Center (of the European Commission)

LV - Latvia

LT - Lithuania

LU – Luxemburg

m - million

M&V – Measurement and Verification

MS – Member State

MT - Malta

NEEAP – National Energy Efficiency Action Plan

NL – the Netherlands

PL - Poland

PT – Portugal

RO – Romania

PEKO - municipal house management authorities in Latvia

PPP – Public-private partnership

RVO - Netherland Entrepreneur Agency

SK – Slovak Republic

SI - Slovenia

SE - Sweden

UK – the United Kingdom

yr. - year

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