Telecommunications, Electricity and Natural Gas Sectors Unbundling: how far should it go?

Abstract

In this paper we discuss the European regulation policy regarding vertical separation in communications, electricity and natural gas sectors. While in electricity and natural gas sectors the discussion concerns ownership unbundling, in communication the regulatory discussion is about functional separation. We conclude that while in electricity ownership unbundling is essential to achieve competition in wholesale markets, in communication sector the regulatory options are deeply dependent on the intensity of network competition between operators that combine different technological platforms.

Keywords: functional separation, electricity, natural gas, next generation networks

1. Introduction

During the last 25 years, both on developed and developing countries, there has been a sound experience of restructuring, deregulation and privatization of sectors that were previously regulated monopolies and/or state-owned. Reasons behind this trend were manifold: technology changes, poor performance of regulated firms and a general ideological shift towards markets are among the most important.

A central feature in debate for network sectors concerns the unbundling question. The options followed until now have been quite diverse: accounting, legal, functional or ownership unbundling.

The EU 3rd Energy Package launched this year, has recognized that ownership unbundling is a crucial instrument to get effective competition, namely when the market remains highly concentrated. However, this is a controversial issue in the electricity sector.

In the communications sector most of the European countries already implemented accounting separation and the present debate is about functional separation. UK introduced it in 2006. Sweden and Italy followed this policy aiming to encourage retail competition. However, other European countries (Netherlands, for instance) regulators decided to maintain vertical integration, mainly arguing that the incumbent firms face competition from alternative networks.

Therefore, at the moment communication, electricity and natural gas face the same question: **how far should the unbundling process go**?

The main goal of this paper is to analyse the arguments in discussion. Also, we analyse the European Regulation and its impact on competition, prices and investment. The paper also aims to answer the following questions:

- Which were the main reasons for different regulatory approaches in the past?
- Presently what are the main regulatory issues in discussion?
- Is it possible to draw some lessons from one sector to the others concerning the effects of different regulatory approaches on competition and investment?

Overall, we conclude that ownership separation seems essential to achieve competition in wholesale electricity markets. For the European natural gas industry, any model of unbundling must guarantee that two core problems are carefully considered: the security of supply and the control of Gazprom unbundling strategy. In

communications the regulatory policy regarding functional separation depends on the intensity of network competition between operators that combine different technological platforms.

The structure of the paper is the following: in section 2 we discuss the vertical separation in the communication sector, focusing in the recent European experiences and on the challenges from the developments of next generation networks. In section 3 we discuss the recent regulatory developments in the electricity sector highlighting the arguments in favour and against ownership unbundling. In sector 4 we analyse the regulatory problems in the natural gas sector and in section 5 we present our main conclusions.

2. The Communications Sector

2.1. Vertical Separation: the European experience

Until 2005, network access was the main instrument used by European regulators to promote efficient entry and competition. Vertical separation, although in discussion, had limited practical implementation. The reasons for this trend can be found in several features of the communications sector when compared with other network sectors, like electricity, natural gas or railways, which continue to be true natural monopolies. This does not happen entirely in the communications network, as many segments the infrastructure monopoly is contested by competing infrastructures, essentially due to technological developments.

Additionally, there are important cost complementarities and economies of scope between network and services. The introduction of new products or the upgrade of the existing ones frequently requires adjustments in the network, and this might be costly under vertical separation (Olsen et al., 2008). These arguments contribute to explain why in most of the European countries the incumbent firms, were privatized a single integrated firm.

However, it is crucial to point out that vertical integration has negative effects on competition, essentially because firms have incentives to discriminate against

competitors.[1] The discrimination can be based on prices or on other strategies, including raising the rivals' costs, reducing the quality of the input delivered to downstream competitors or reducing rivals' demand.[2]

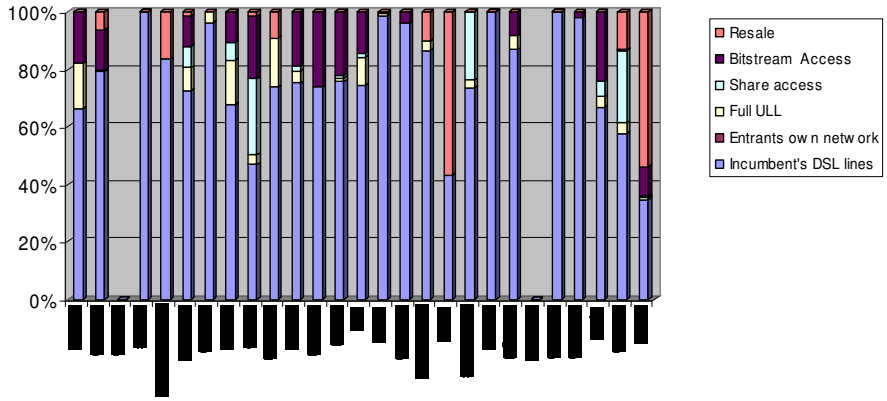
Additionally, vertical separation may allow a reduction on the regulatory intervention, as anticompetitive behaviour is much less likely to occur[3] and this effect is more intense as deeper is the vertical separation.

Recently the European debate about vertical separation was intensified and accompanied by some implementation. Certainly, this trend is not independent on the observation that, in several markets, the access regulation was not able to develop real competition in the downstream segments (Bijl, 2005). Olsen et al. (2008) referred that, in the Danish market for ADSL-services, it is even difficult to ensure equal treatment of all operators through regulation. Also, in Italy, there was a slow implementation of LLU until 2006 (Baake, 2006). For the UK, Whalley and Curwen (2008) argues that "Service based competition had been possible since the late 1990s but had enjoyed limited success because, it was alleged, BT had abused its dominant position".

In order to analyze the development of retail competition we present information about the fixed broadband access market (Tables 1 and 2). Four different types of access are referred: (i) Resale (the entrant firm resells the services provide by the incumbent, without introducing specific features); (ii) Bitstream access (the incumbent installs a high speed access to the final consumer and the entrant uses this access, having some freedom in the definition of its services); (iii) Share access (incumbent and entrant use the same line, the incumbent continues to deliver telephone service and the entrant provides high speed data services); (iv) Full local loop unbundling (the incumbent rents a line that is exclusively used by the entrant, which allows more freedom in the specification of its services).

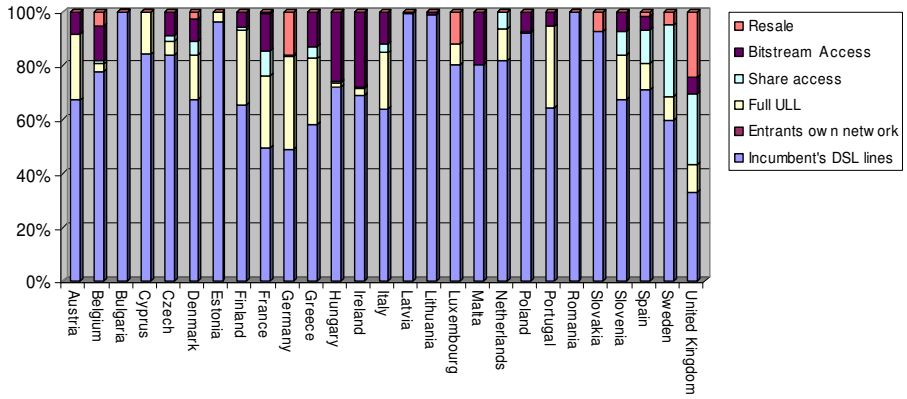
[1] To a deeper discussion of this argument see Cave (2008), Doyle (2008) and the references therein.
[2] These strategies are often called sabotage. For details see Mandy and Sappington (2007).
[3] For a detailed description of the merits and disadvantages of functional and structural separation see Bijl (2005) or OCDE (2003, 2007). For an analytical approach see Sappington (2006), Doyle (2008), Kirsh and Hirschhausen (2008) and Gomez-Ibanez (2003).

Table 1 - DSL lines, July 2005



Source: EC (2008a)

Table 2 - DSL lines, July 2008



Source: EC (2008a)

In this period 2005-2008, and for most of the countries, new entrants had globally gained market share. In Slovenia, Germany and Portugal the new entrants' DSL lines increased 30.7, 22.5 and 24.8 percentage points. The significant exceptions are Malta, Belgium and Netherlands, with decreases of 37.4; 14.7 and 8.4 percentage points, respectively.

There was also a reduction in resale and a pronounced increased in the types of access that allow the development of differentiate strategies for the entrants (in particular Full ULL). Malta and UK are two cases of a strong reduction in the proportion of resale (56.8 and 29.6 percentage points, respectively). Portugal, France and Greece are the countries with higher increases of Full ULL (25.3; 23.6 and 20.3 percentage points, respectively).

Overall, this information suggests that in this period there was an increase in the competitive level of the retail broadband markets.

In Europe the debate on vertical separation came to the front of discussion with the implementation of functional separation of British Telecom in 2006. In 2005, Ofcom studied the vertical separation of British Telecom in two companies, one of which would supply retail services while the other would supply the wholesale services to all suppliers of retail services. However, in 2006, and with the agreement of BT, Ofcom decided for functional separation, which does not involve the creation of a legal independent firm. Functional separation implies the separation of the parts of the network that are difficult to replicate but that are necessary to provide final services (ERG, 2007). The decision leaded to the creation of Openreach, a division operationally independent from BT. Openreach is in charge of the management of the incumbent's network and also of the provision of access to the network, not only to the retail departments of BT but to independent operators as well. Accordingly to Ofcom this arrangement is more effective in securing non discriminatory practices and in encouraging investment in network than the access price regulation.[4] The evaluation made by Ofcom of the functional separation is globally positive.[5] This is supported by the significant increase in the unbundled lines in UK: the sum of Full ULL with Share access lines increased from 73 140 in 2005 to 4.76 millions in 2008 (EC, 2008a). Notwithstanding, Ofcom systematically mentions several features that need to be improved. One is the separation of the information systems between Openreach and the rest of BT. Without this separation that requires the effectiveness of the "Chinese walls", is quite difficult to avoid the non-discriminatory behaviour of BT.

Meanwhile, in 2007, the EC considered functional separation as a remedy available to the National Regulatory Authorities, along with traditional remedies.

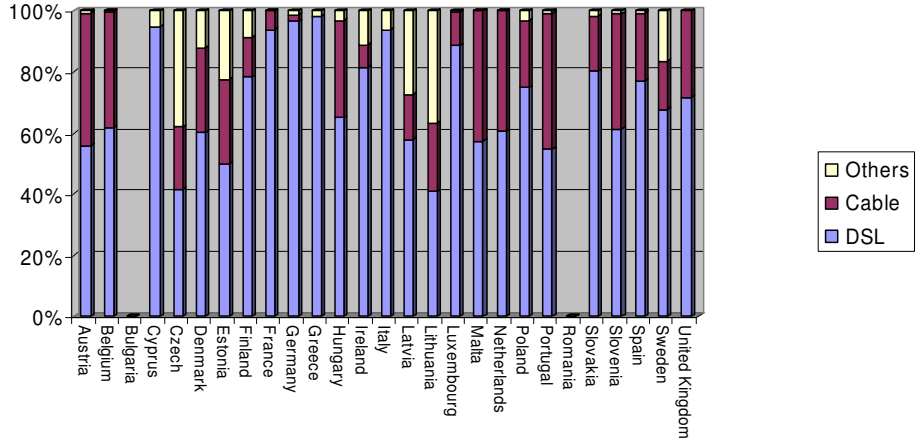
Several other European regulators and incumbent firms are studying functional separation. In 2008, Telecom Italia announced the creation of Open Access, a division inspired in the UK Openreach (Whalley and Curwen, 2008).[6] In Denmark there are also some proposals to follow the UK example (Olsen et al., 2008). In 2007, the Netherlands regulator decided not to implement vertical separation. The main arguments relay on the

[4] This opinion is also shared by Reding (2007).
[5] For a detailed analysis and reference of the Ofcom evaluation reports see Whalley and Curwen (2008).
[6] According to Amendola et al. (2007), operational separation was introduced in Italy in 2002, and its positive effects in terms of increasing of LLU lines and decline in wholesale prices were already visible in 2005. The operational separation is a lighter form of vertical separation than functional separation. For a detail comparison between the Italian and the British models see Amendola et al. (2007).

existence of an alternative infrastructure (cable), and on the potential negative effects on investment in NGN (Whalley and Curven, 2008). On the contrary, in 2008, TeliaSonera agree with the Swedish regulator the implementation of functional separation.

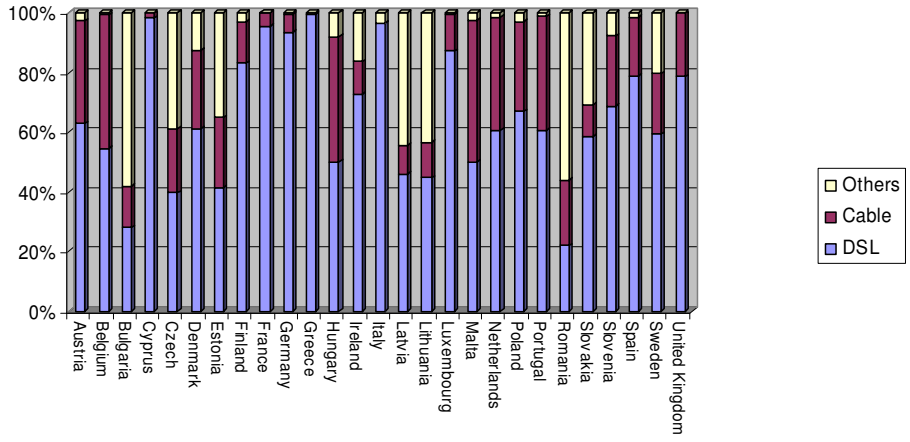
Overall, we conclude that in recent years there is a great diversity of strategies among the European countries concerning vertical integration. As one important argument is based on the development of alternative infrastructures, we present in detail information (Tables 3 and 4) about the weight of each infrastructure.

Table 3 - Broadband access July 2005



Source: EC (2008a).

Table 4 - Broadband access July 2008



Source: EC (2008a).

It stands out that DSL continues to be the dominant infrastructure in the broadband access in several countries. In France, Germany, Greece, Italy and Cyprus, the DSL has a market share above 90%. Then, it is difficult to consider that the

competitive pressure of the alternative platforms is a strong argument in favor of the vertical integration. On the contrary, in Netherlands, Belgium and Sweden, DSL has a market share below 61%.[7]

Also, Member States where DSL is the dominant platform are among those that have more broadband lines: Germany has 20.1% of all broadband fixed lines of the 27 European countries, UK and France has 15.5% and 15.4%, followed by Italy, Spain and Netherlands (EC, 2008).[8]

2.2. The effects of vertical separation on investment

In spite of the positive effects, vertical separation also has some drawbacks. Besides the structural effects not easily reverted, two other negative effects must be discussed:

i) Vertical separation might increase the costs of coordination and sacrifice economies of scope;

ii) Vertical separation might reduce the incentives to invest and to innovate.

The introduction of new services frequently requires adjustments in the network and this might be costly to implement under vertical separation (Olsen et al., 2008). One example of this problem is found in the complaints of UK independent operators about the interaction with BT after the creation of Openreach. Furthermore, Amendola et al. (2007) argue that for higher types of vertical separation (as is the case of functional separation relative to operational separation) the negative effects are more pronounced due to an increase in cost transactions and to the lower incentives to invest and innovate.

Vertical separation can reduce the incentive to invest and innovate as:

i) the easier access to the incumbent's network discourages the investment by independent operators in their own networks, and then the "ladder of investment"[9] is

[7] Notice that in several countries (Bulgaria, Czech Republic or Romania) the market share of DSL is low but the absolute values for broadband lines in these countries are also (see Table 4 in the Appendix).

[8] See Table 4 in the Appendix.

[9] The "ladder of investment" theory (Cave and Vogelsang, 2003; Cave, 2006) foresees that initially the entrant firms use the incumbent firm's network to deliver their products and this allows retail competition. After the initial period, new entrants will invest in their own infrastructure competing with the incumbent firm also at the upstream segments of the market.

interrupted. Therefore, the regulatory goal of developed infrastructure competition might be weakened. The empirical observations of Crandall and Sidack (2002) for the USA markets support this argument. Furthermore, the vertical separation might intensify the dependence of the alternative operators from the incumbent's network.

ii) may cause a delay in the decisions to invest in particular when the coordination between network investments and services specifications is crucial. Amendola et al. (2007) relate the delay in UK investments in NGN with the functional separation of BT, arguing that the countries where functional separation was not adopted are also the countries with more investment in NGN.

iii) may reinforce the market power at the wholesale level with negative consequences for the development of infrastructure network competition and, thus, with negative effects on investment and innovation at this level.

2.3. Next generation networks (NGN)

With the development of NGN, the same network can deliver to final consumers different services (voice, data, video, high definition television, etc). Then, there is room for significant economies of scale and scope (Doyle, 2008; ERG, 2007). This perspective supports the argument of the incumbent firms that wish to maintain and develop vertically integrated networks. In this context, old concerns about the exercise of market power the network rise out again. "Leveraging market power in telecommunications is a live and real issue and is becoming more pertinent in the context of NGN and NGA investments" (Doyle, 2008).

The communications sector is at this moment in a crucial period. Huge investments in fibre optical network are vital for the development of the NGN. And the incumbent firms are large investors. Functional separation, designed to solve more efficiently the problem of discrimination of the independent operators may have negative effects on the incentives to invest. As was mentioned above OPTA decided not to implement functional separation because of the potential negative effects on the incentive to invest in NGN.

Additionally, the technical changes introduced by NGNs might have consequences on the decision of vertical separation. Until recently "telecommunication

services were delivered on dedicated networks: telephony on PSTN, data services on data networks, television on cable networks." (Olsen et al., 2008), and access price regulation intended to incentive downstream competition. However, this is rapidly changing with the development of NGN and it is foreseeable the development of competitive networks. A re-evaluation of the arguments in favor and against vertical separation in communication sector is necessary in this new framework. For instance, Kirsch and Hirschhausen (2008) argue that, from a technological point of view, as NGN allow the provision of several services thought the combination of different physical network infrastructure, there will be a separation of infrastructure and services and, consequently, a reduction in the economies of scope between infrastructure and services. Then, the authors claim that "structural separation becomes less costly as technical synergy losses from the separation of access networks are mitigated" (Kirsch and Hirschhausen, 2008. p.71).

Therefore, firms can offer to final consumers bundles of services (triple play, for instance) that are provided through the combination of different technological platforms. Competition between vertically integrated firms that in the past had a single dominant technology may be reinforced.

3. The electricity sector

3.1. The electricity sector: the rationale of EC Directives

The physical characteristics of the electricity supply industry are the main determinants of its optimal regulatory design. The industry has large sunk costs, its value chain is composed by four vertical stages with different optimal scales (generation, transmission, distribution and retailing) and it is a single product industry of a non-storable good delivered through a network, requiring instantaneous supply and demand physical balance.

Balancing generation and consumption is one of the most complex technical problems to be solved. It arises from the electricity market specific features: the need for continuous electrical equilibrium, unexpected demand and supply fluctuations, a limited capacity to establish and send price signals to market participants on a continuous basis and also a small short-run elasticity of demand Fehr et al. (2005).

A real-time balance between generation and electricity consumption (both by end users and the grid itself) is crucial for safeguarding transmission system security. As electricity is not storable, disturbances of equilibrium between generation and load make the system frequency to deviate from its set value which, according to the extent of that deviation, can affect the behavior of electrical equipment or lead to the (protective) disconnection of generation plants. Large deviations may even cause system black-outs.

Different types of transmission institutional arrangements may cover either partially or completely the interconnected and synchronized power system. Almost all continental European systems (managed by different transmission organizations under different regulations) are interconnected and synchronized (every system has the same frequency all the time). These interconnected systems create strong externalities between zones (e.g. loop flows[10]). This is not the case for the UK power system. It is an "isolated" system, thus it is not synchronized with the continental system (it is interconnected by DC lines[11]). In this case, externalities are much smaller than in continental Europe as there are no loop flows. Thus, the coordination of the whole European power system is not an easy task but it is an absolute condition, as to increase cross-border competition as well as the internalization of cross-border externalities

The importance of transmission, a natural monopoly that has to be regulated, is not proportional to its share on the total cost of supplied electricity: about 5% according to some authors always under 10% according to others[12]. Retailers and generating firms (particularly those with large power plants) have the greatest interest on transmission network.[13] Both for generation and retailing, competitive markets suppose access to the network on equal, non-discriminatory conditions. This is the main reason why unbundling is necessary. However, how far this should go remains controversial.

---

[10] **Loop flow:** The movement of electric power from generator to load by dividing along multiple parallel paths; it especially refers to power flow along an unintended path that loops away from the most direct geographic path or contract path (EIA Energy Glossary).

[11] **Direct current** (**DC**) is the unidirectional flow of electric charge. Direct current is produced by such sources as batteries, thermocouples, solar cells, and commutator-type electric machines of the dynamo type. Direct current may flow in a conductor such as a wire, but can also be through semiconductors, insulators, or even through a vacuum as in electron or ion beams. In direct current, the electric charges flow in a constant direction, distinguishing it from alternating current (AC).

[12] See, for example, Thomas (2007) and Marques (2003).

[13] Households and industrial customers (except a very small part of the largest consumers that are supplied directly by the transmission network) are connected to the (low voltage) distribution network. Small generators and most renewable and combined heat and power (CHP) generators feed directly into the distribution network.

3.2. What has failed in the liberalization process?

Until 1996, the European power transmission systems were owned, developed and managed by vertically integrated firms. The unbundling process dates from the 96/92/CE Directive which introduced independence of Transmission Operators (TSO) and Distribution Operators (DSO) from generation and trade. For TSOs this separation should be*, at least* on management, and for DSOs the independence should be on accountability. The 2003/54/CE Directive went further. Transmission and Distribution should be, at least, legally unbundled. Thus, for both segments of the value chain, management should be legally independent from generation and supply.

The rationale behind EC legislation was twofold: the concern about non-discriminatory access to electricity (and gas) networks and a reasonable doubt on whether current arrangements were delivering efficient and timely investments in transmission capacity. The need for the improvement of transmission investment is closely related to liberalization and competition. Congestion of the transmission networks has greatly increased with the development of wholesale markets (Joskow, 2005a, 2005b). This is also referred by Hirst (2004) who also argues that investment in transmission capacity has not followed the pace of changes in trading patterns. Joskow (2006) explains how transmission congestion (and related reliability constraints) creates load pockets, thus reducing competition among generators, and how this leads policymakers to impose mitigation rules which create other kind of market distortions.

Sector enquiries carried out by the European Commission in 2005 and 2006[14] concluded for the existence of severe problems concerning the effective liberalization of the European energy market, namely: insufficient market integration, lack of transparency, lack of confidence on prices determination, market concentration and small downstream market competition.[15]

Market integration is a fundamental tool to improve competition in national markets. Although great improvements have been made - real capacity margin have improved from less than 5% in 2005 to 7.6% in 2006 - there is still a large work to be done to get a fully integrated market. Most of the European countries present an interconnection capacity (in relation to installed generation capacity) between 10% and 30%. Part of the lack of investment in interconnections can be explained by conflicts of

[14] See EC (2005, 2006, 2007a and 2007b).
[15] For a detailed analysis see EC (2002, 2003, 2004, 2005, 2006, 2007b, 2007c, 2008).

interest within vertically integrated utilities. Strategic response by agents with market power may oppose investment objectives. However, there are other reasons as well, namely strategic and political.

Both the lack of transparency and the lack of confidence on prices determination may be translated, among others, by the diversity of prices and the consumer perception on change of electricity prices.[16]

While there are prices that can be easily explained, there is also evidence of large discrepancies which are less understandable. Different kinds of fuels used in generation can be responsible for both high prices and high price volatility. Weather conditions are another cause of high prices, for they can explain more pressure on demand and, in the case of small rain, the reliance of electricity generation on thermal plants. However, the diversity of tax share on final prices is also remarkably wide. Moreover, as EC studies on impact assessment recognize (EC, 2007d) from 1998 to 2006, in countries with ownership unbundling, household electricity prices rose by 5.9%, while the increase in countries without ownership unbundling attained 29.5%. However, it is important to notice that between 1998 and 2006, several European countries have applied regulated tariffs for household consumers which can explain why prices were not as sensitive to changes in market conditions as it could be expected.

Despite the bias introduced by the existence of regulated industrial tariffs in some countries, there is an evident dispersion of prices for the same type of customer. Tax share on final prices also presents significant differences among member states. In ownership unbundled markets[17] the electricity price for industrial consumers decreased from 1998 until 2006 by 3.0%, while in markets without ownership unbundling this price increased by 6.0% (EC, 2007d).

The electricity market is highly concentrated (EC, 2009). Out of 25 countries, 12 presented a Herfindhal-Hirschman Index[18] above 5 000 for the electricity generation segment (very high concentration), 5 were highly concentrated (HHI between 1 800 and 5 000) and only 8 of them had a moderately concentrated generation structure (HHI between750 and 1800).

[16] See Tables 1A, 1B and 2 in Appendix.
[17] See, for instance, EC(2007a) and Thomas (2007)
[18] The Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers.

Concentration in the retail market is also remarkable. Out of 28 countries (27 member states plus Norway), 6 had one company dominating over 5% of the retail market and, for 22 of them, the 3 largest companies had an aggregated market share over 40% (EC, 2009).[19]

The 3rd Energy Package still under discussion[20], represents a strong attempt by the EC to reinforce the unbundling and its effects on competition, and to solve electricity and gas problem of network under-investment.

The effects of vertical integration of the electricity and natural gas industries on competition and investment have been recognized since the 1st Directive in 1996. Although the regulatory reform has unbundled generation and supply from transmission and distribution and introduced competition into the electricity wholesale and retail markets, market liberalization is still far from being fully accomplished.

3.3. The unbundling issue

Under accounting unbundling, integrated utilities could allocate costs to the advantage of the firm. As there were common costs shared by generation and transmission, the opportunity to have a substantial share of those costs allocated to the network business was real. This inappropriate cost allocation resulted in (inappropriate) scale economies.

Legal unbundling is a better form of unbundling, as it requires that the grid should be owned and operated by a firm whose exclusive activity is the network business. Although the cost allocation issue might be solved, other problems may arise due to the fact that the network can be owned by a firm which may belong to the same holding group.

Although the 2007 EC proposal was concentrated on the debate upon two particular institutional arrangements of the electricity transmission – the Independent Transmission System Operator (ITSO) and the Legally Unbundled Transmission

[20] On the 23th March the European Parliament and the Czech EU Presidency reached an informal compromise on the third energy package. This agreement still needs to be approved by the full EU assembly and the member-states representatives in the Council of Ministers. On the unbundling issue, the outcome was the agreement on the" third option" involving a strong independent transmission operator both for electricity and gas.

System Operator (LTSO) – other 5 models of transmission ownership can be identified worldwide: the Independent System Operator (ISO), the Hybrid Independent System Operator/Independent Transmission Owner (ISO/ITO) and the traditional model of Vertical Integration (VI).

The National Grid in England and Wales is an example of ITSO. It is fully unbundled from the rest of the system and the firm owns and operates transmission assets. According to Lévêque et al. (2008), this may be the first-best arrangement under a national (isolated) perspective framework, where the transmission organization and the regulator cover the entire system. These cases have no cross-border externalities and cross-border competition in generation is small.

An example of LTSO is the French RTE since 2005. The transmission owner and the operator are independent but they are 100%-owned by the vertically integrated utility. According to Pollitt (2008), this is an increasingly common model.

The ISO model exists in several electricity markets, including the USA and in Europe. In the USA, it is the case for PJM Interconnection,[21] and in Europe for the Scottish Electricity. The system operator does not own the transmission assets but it is ownership-unbundled from the rest of the system.

In the ISO/ITO hybrid model, both of the organizations are ownership unbundled from the rest of the system and the Independent Transmission Owner (ITO) has no operation function. This is the case for Nord Pool, but also for Argentina and Chile. Nord Pool is a particularly interesting case, namely due to the ISOs regional coordination and to the significant public ownership of assets.[22]

Finally, there is still the vertically integrated utility (VI). While the Directives have introduced regulation that removed this model from the possible institutional arrangements, it is still *de facto* in place in some European power markets.

The impact assessment presented by the EC to support ownership unbundling, covered a wide range of variables. Most of these impacts were analysed on past empirical evidence. According to those studies, full ownership unbundling revealed a general positive impact on the energy market, in particular by stimulating investment, reducing market concentration and contributing to the reduction of energy prices. On the other hand, there was no empirical evidence of eventual negative effects on credit

[21] PJM is a regional transmission organization that manages the high voltage electric grid and the wholesale electricity that serves 13 states and the District of Columbia.
[22] See Bergman, (2002, 2003).

ratings, share prices, R&D and the relationship with external suppliers (EC, 2007d). Due to the EU dependence on fuel imports, namely on Russian gas, ownership unbundling present, according to the Commission, another advantage: it will ensure that "energy networks can not be owned neither by EU suppliers nor by non-EU supply companies" (EC, 2007d, p.45).

However, the criteria to analyse (and make the ranking of) different institutional arrangements vary. Some recent studies[23] present different criteria choices for that evaluation. In some cases, aggregated criteria are not the best choice to analyse the electricity sector. Brattle (2008) used investment[24], as an aggregated criterion, which may be critical as problems in investment may stem from a variety of reasons: lack of incentives, non-discriminatory access problems or bad coordination between the Transmission Operator (TO) and the System Operator (SO). De Vries (2008) defined three criteria: economic efficiency, playing field for competition and regional market integration. In the first one he included efficient network operation, efficient generation & transmission investments and low transaction costs. The second includes no cross subsidies networks/generation and no leakage of "sensitive" information and, naturally, market-neutral network investment.

According to Lévêque et al. (2008), De Vries methodological approach is consistent with their own, a particularly exhaustive set of five criteria used on a report financed by Endesa: economic efficiency corresponds to their first three criteria (transaction cost savings, performance-based regulation implementation, conflict of interest), level playing field for competition to non-discriminatory access while benefits from regional integration stands as a common criterion. For Lévêque et al. (2008), ITSO would be the first-best arrangement when transaction costs savings and/or benefits from the implementation of performance-based regulation (the 2nd criterion) are greater than the benefits from mitigating cross-border effects. However, ISOs/ITOs and ISOs/LTOs would become the first-best arrangement when the benefits from mitigating cross-border effects are superior to transaction costs savings and/or the implementation of performance-based regulation.

A very final conclusion of this report is particularly interesting, at least in the way we understood it. The authors agree on that regional integration should be a first priority criterion to choose among different institutional arrangements. And, despite

[23] See, for instance, Brattle (2008), De Vries (2008) and Lévêque et al. (2008).
[24] And also TO/SO transactions savings and regional market integration.

their conclusion that the ISO option appears to be better than ITSO, they admit the existence of a strong regional regulator and a strong regional regulatory framework as the essential conditions for the success of the ITSO option. This is also our perspective.

4. Transmission unbundling in natural gas

The European gas market is still more problematic than the electricity market, as incumbents usually control imports and/or domestic production. Concentration is much higher than for electricity (EC, 2008): only the UK market is moderately concentrated (HHI between 750 and 1800), five other countries have an HHI between 1800 and 5000 and all the others have HHIs above 5000. Vertical integration is also extremely high as there is often one firm that controls both production and distribution. Furthermore, market fragmentation corresponds to country area. Thus, the unbundling issue is crucial for the liberalization of the gas market.

Technological and environmental reasons support the increasing in consumption as well as the need for the diversification of energy supply. The European domestic gas production and domestic reserves are decreasing and the dependence on gas imports has been strongly increasing (50% in 2007 and 80% in 2030). Most of the imported gas come from Russia (in 2030, it will represent 50%), from the monopolistic, full-integrated Gazprom whose recent strategy has been to capture the full value chain margin and to enter the retail segment.

4.1. Ownership unbundling: empirical evidence

From the actual situation concerning TSO unbundling, it is evident that ownership unbundling is still the exception as an institutional arrangement.[25]

There are "old" member states that have not yet accomplished the final step towards full unbundling, namely Austria, Belgium, France, Germany, Ireland and Luxembourg. Some of them –France, Germany and Austria – have led a hard resistance to the EC unbundling plans and even proposed a "Third Way"(Effective and Efficient Unbundling) an identical position taken as for the electricity sector, supporting an

[25] See Table 3 in Appendix.

alternative TSO with increased control capacity as well as a package of measures to improve coordination among transmission organizations (EEUTSO, 2008).

While in the USA there are several examples of ITSOs and there is even a consensus upon the role played by this institutional arrangement in the implementation competitiveness in gas markets (Jamasb et al, 2006) this is not the case in the EU. Moreover, according to the EC, the dominant vertical integration (VI) model and even the Legally Unbundled TSO (LTSO) model have created serious problems concerning conflicts of interest with negative effects on competition and a distortion of investment incentives (EC, 2007d).

4.2. National champions?

The 1st Electricity Directive imposed accounting unbundling and the 2nd Directive required legal unbundling. Notwithstanding, the regulatory framework for the gas sector reform remained quite behind. Although, since the 1st Directive (1998/30/EC) the publication of accounts has been mandatory- according to the Gas Directive, separate accounts should be published by 10th August 2000 -, there was no imposition of legal or management unbundling. The EC requirement only concerned the account separation, in the internal accounting of natural gas integrated firms, for the transmission, distribution and storage activities (Article 13(3)). The same applied to the transmission and distribution operators. The 2nd Gas Directive imposed legal unbundling of TSOs until 1st July 2004, while considering that the legal unbundling of DSOs could have two exemptions beyond 1st July 2007.

In 2002, four basic unbundling models could be observed:

- France, Germany, Luxembourg and Sweden imposed the accounting unbundling of the incumbent and its transport segments of the value chain.
- Austria, Belgium, Denmark and Italy had legal unbundling.
- Netherlands and Ireland implemented management unbundling.
- Only the UK and Spain introduced ownership unbundling.

Between 2002 and 2005, both the UK maintained ownership unbundling and Austria and Belgium sustained legal unbundling. Legal unbundling of German gas trade and transport firms was partly accomplished along 2005. Four other countries moved from legal unbundling to ownership unbundling: Denmark, Italy, Netherlands

and Sweden. On the opposite, Spain revised its unbundling model, giving a step back to legal unbundling.

According to Haase (2008), the Irish and the Luxembourg cases remain unclear. Although the Irish regulator assured that management unbundling had been applied, the 5th Benchmarking Report stated that Ireland had not effectively applied legal unbundling. The Luxembourg case is still more disappointing: according to the successive EC benchmarking reports, by the end of 2005, there was no legal unbundling although accounting unbundling and then management unbundling had been applied.

From 2005 to the present the ownership unbundling of trade and transport have been rejected almost unanimously by member states. Gas companies appeared like national champions supported by national governments. The only effective step forward, at least for a majority of member states, was the agreement upon the idea of regional gas initiatives (RGI) as it can facilitate market integration and regulatory harmonization.

5. Conclusions

The three sectors under analysis have quite different features which naturally impose diverse regulatory options. Both electricity and natural gas are single product industries while in communications there is a proliferation of services, with an increasing degree of complementarily. Additionally, the rate of technological innovation is quite different among these sectors. In communication sector there is an increasing high rate of new services, new networks functionalities and, more recently, the convergence of networks. This rapidly changing environment reshapes competition features and demands specific regulatory approach. Regarding the unbundling issue, we conclude that the regulatory policy in communications is much less mandatory than in electricity or natural gas.

The innovation rate for electricity and natural gas has also been much lower than for the communications. This feature certainly contributes for the deeper implementation of the unbundling process. Therefore, the regulatory experience in those sectors, namely the identification of the problems with functional and legal unbundling, brings important lessons for the communications' regulatory policy. In the context of electricity and natural gas the following problems still deserve hard work:

(i) The evaluation of costs associated to the formation of a new ITSO firm. Beyond initial costs, there are also additional costs for (high quality data) information systems. Social and cultural costs may also be remarkable in some situations as the negotiation with stakeholders may be rather complicated. The costs from the loss of scale economies for those firms that were previously integrated will be very high. The situation may be even more complicated in the case of the transmission systems of small countries.

(ii) Should gas and electricity markets be treated differently? For the moment, we are convinced that whatever the model arrangement, the regulation of the gas transportation network unbundling must consider two core issues: the security of supply and the dangerous "super bundling" strategy of the Russian monopolist Gazprom.

(iii) The empowerment of the European Agency for the Cooperation of Energy Regulators (ACER). We are convinced that it is crucial for successful market integration and for the security of supply.

(iv) The monitoring of the network performance demands constant investments in order to avoid costly interventions. However, there are problems in network performance that are difficult to detect. A short-term time-horizon investor may neglect this particular characteristic of the electricity industry.

The solutions to these problems certainly will be important insights to the communications sector. Until now, most of the European countries implemented accounting separation. Some also implemented functional separation (UK, and more recently, Sweden and Italy). This path approximates communications to the electricity sector. However, with the recent changes introduced by NGN the old questions of vertical separation emerged once again. Some claim that, with competing networks, vertical separation might no longer be defendable. Others still strengthen the advantages of vertical separation, arguing that the alternative technologies had not yet created real competition in the market. Overall, we conclude that the analysis of the competition level between operators that combine different technologies is a crucial step to discuss the regulatory options on unbundling in the communications sector.

References

Amendola, G. ; Castelli, F. and Serengecti, P. (2007), "Is Really Functional Separation the Next Milestone in Telecommunications (De)Regulation?", paper presenter at the 18th European Regional ITS Conference.

Baake, P. (2006), "Introduction in "Local Loop Unbundling and Bitstream Access: Regulatory Practice in Europe and the U.S.", Baake, P. and Preissl, B., edts, DIW Berlin.

Bergman, L. (2002), "The Nordic Electricity Market: continued success or emerging problems?", *Swedish Economic Policy Review*, no.2.

Bergman, L. (2003), "European Electricity market Integration: The Nordic Experiences". *Research Symposium European Electricity Markets*, The Hague.

Bijl, P. (2005), "Structural Separation and Access in Telecommunications Markets", CESifo working paper no. 1554.

Brattle (2008), "Independent System Operators for Power Transmission: Evidence-Based Assessment", The Brattle Group, April.

Cave, M. (2006), "Encouraging Infrastructure Competition Via The Ladder of Investment", *Telecommunications Policy*, 30, 323-237.

Cave, M. and Vogelsang, I. (2003), "How Access Pricing and Entry Interact", *Telecommunications Policy*, 27, 717-727.

Crandall, R and Sidak, J. 82002), "Is Structural Separation of Incumbent Local Exchange Carriers Necessary for Competition?. *Yale Journal on Regulation*, Vol. 19. 335-411.

David M. and Sappington, D. (2007), "Incentives for sabotage in vertically related industries," *Journal of Regulatory Economics*, Springer, vol. 31(3), pages 235-260, June.

De Vries (2008), "OU, ISO, RSO, EEU: What are the issues? What are the choices?", Presentation Eurelectric Workshop in *The 3rd Energy Package: alternative models for System Operation, Regional Integration and Unbundling*, Brussels, March.

Doyle, C. (2008), "Structural Separation and Investment in the National Broadband Network Environment" Final report for Optus.

EEUTSO (2008), "Effective and Efficient Unbundling of Transmission System Operators", Proposal for a Directive of the EP and the Council amending Directive 2003/54/EC concerning common rules for the internal market in

electricity and repealing Directive 96/92/EC (Austria, Bulgaria, Germany, France, Greece, Luxembourg, Republic Latvia and Slovak Republic).

EIA- Energy Information Administration (2008), available at http://www.eia.doe.gov/a-z_index/Energya-z_l.html.

ERG (2007), "European Regulatory Group Opinion on Regulatory Principles of NGA", available at http://www.erg.eu.int/doc/publications/erg07_16rev2_opinion.

European Commission (2002), Second Benchmarking Report on the Implementation of the Internal Electricity and Gas Market, EC, Brussels.

European Commission (2003), Third Benchmarking Report on the Implementation of the Internal Electricity and Gas Market, EC, Brussels.

European Commission (2004), Annual Report on the Implementation of the Gas and Electricity Internal Market, COM/2004/0863.

European Commission (2005), Corrigendum to the 2005 report, Report on the Progress in creating the internal gas and electricity market, COM/2005/0568.

European Commission (2006), Prospects for the internal gas and electricity market (COM/2006/0841)

European Commission (2007a), "Proposal for a Directive of the Parliament and of the Council amending Directives 2002/21/EC, 2002/19/EC and 2002/20/EC", 13th November.

European Commission (2007b), Progress in creating the internal gas and electricity market, COM/2008/0192.

European Commission (2007c), DG Competition Report on Energy Sector Inquiry, Brussels.

European Commission (2007d), Commission Staff Working paper, SEC(2007) 1179, Accompanying the legislative package on the internal market for electricity and gas – Impact Assessment, Brussels.

European Commission (2008a), "Broadband Access in the EU: Situation at 1 July 2008", COCOM08-41 FINAL, available at http//:ec.europa/information_society.

European Commission (2008b), Progress in creating the internal gas and electricity market, COM/2009/0115.

European Commission (2009), DG Tren Staff Working Document, Report on Progress in Creating the Internal Gas and Electricity Market Technical Annex to the Communication from the Commission to the Council and the European Parliament, COM(2009)115.

Fehr , N.; Amundsen, M.; Eirik S. and Bergman, L. (2005), "The Nordic Market: Signs of Stress?", *The Energy Journal* Special Issue "European Electricity Market Liberalisation", 71-98.

Gomez-Ibanez, J. (2003), "Regulating Infrastructure: Monopoly, Contracts and Discretion, Harvard University Press.

Haase, N. (2008), "European Gas Market Liberalisation: Are Regulatory Regimes Moving Towards Convergence?" *Oxford Institute for Energy Studies*, NG 24, ISBN 978-1-901795-73-8.

Hirst, E. (2004), "US Transmission Capacity: Present Status and Future Prospects", Washington, D.C., Edison Electric Institute. October, available at http://www.eei.org/industry_issues/energy_infrastructure/transmission/USTransCapacity10-18-04.pdf.

Jamasb, T.; Newbery, D.; Pollitt, M. and Triebs, T. (2006), "International Benchmarking and Regulation of European Gas Transmission Utilities", paper prepared for the CEER-Council of European Energy Regulators.

Joskow, P. (2005a), "Transmission Policy in the United States", *Utilities Policy* (13), 95-115.

Joskow, P. (2005b), "Patterns of Transmission Investment". Mimeo, available at http://econ-www.mit.edu/faculty/download_pdf.php?id=1133.

Joskow, P. (2006), "Markets for Power in the United States: Na Interim Assessment", *The Energy Journal,* vol. 27, no.1, 1-36.

Kirsh, F. and von Hirschhausen, C. (2008), "Regulation of NGN: Structural Separation, Access Regulation, or No Regulation at All?", *Communications and Strategies*, 69, 63-83.

Lévêque, F.; Glachant, J-M.; Saguan, M. and Muizon, G. (2008), "Comparing Electricity Transmission Arrangements: Revisiting the Main Arguments from the Economic Literature to Shed Light on the EU 3rd Directive Debate". Miméo. July 9, Paris.

Marques, V (2003), "Poder de Mercado e Regulação nas indústrias de rede", Gepe-Gabinete de Estudos e Prospectiva Económica, Ministério da Economia, ISBN 972-9128-02-2, Lisboa.

OCDE (2007), *Convergence and Next Generation Networks*, Ministerial Background Report.

OECD (2003), "The Benefits and Costs of Structural Separation of the Local Loop", *OECD Digital Economy Papers*, No. 76, OECD publishing, © OECD. doi:10.1787/232804472031.

Olsen, O. ; Henten, A. and Falch, M. (2008), "Functional Separation in Telecommunications: A Comparative Analysis of Infrastructural Areas", working paper.

Pollitt, M. (2008), "The Arguments for and Against Ownership Unbundling of Energy Transmission Networks", *Energy Policy,* vol. 36, issue 2, February, 704-713.

Reding, V. (2007), "Better Regulation for a Single Market in Telecoms", speech/07/624, Plenary Meeting of the European Regulators Group, Athens.

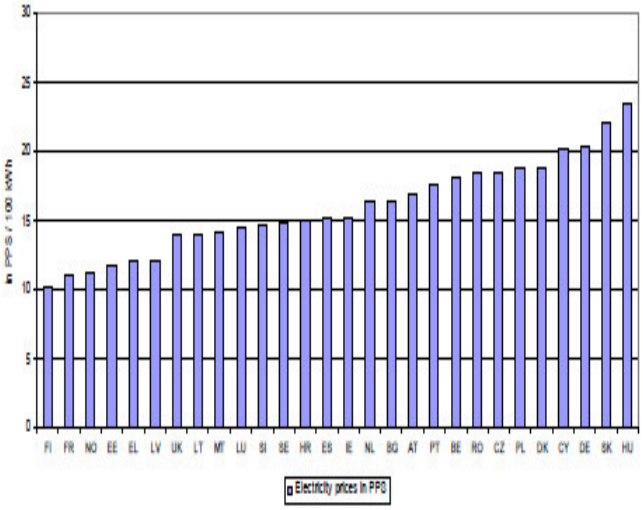
Sappington, D. (2006), "On the Merits of Vertical Divestiture", *Review of Industrial Organization*, 29, 171-191.

Thomas, S. (2007), "Unbundling of Electricity Transmission Networks: Analysis of the European Commission's position", Mimeo, April. Public Services International Research Unit (PSIRU), University of Greenwich.

Whalley, J. and Curwen, P. (2008), "Is Functional Separation BT-Style the Answer?", Communications & Strategy, no.71, 3rd quarter, 145-165.

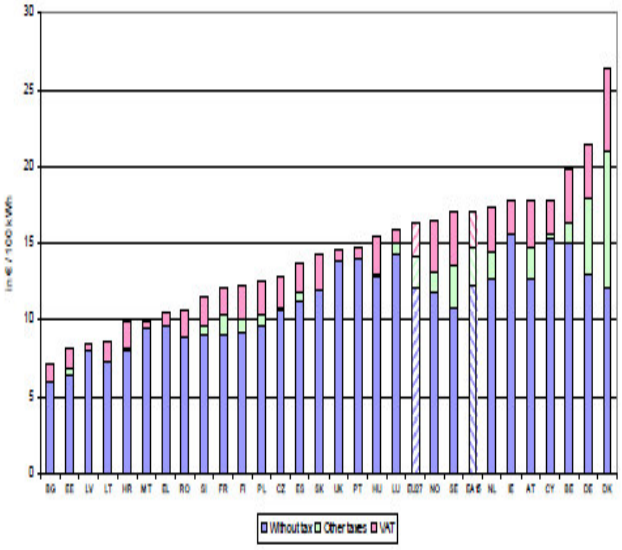
Appendix

Table 1A – Electricity Prices for Household Consumers*(2008s01) in Purchasing Power Parity (PPP



Source: EC (2009)

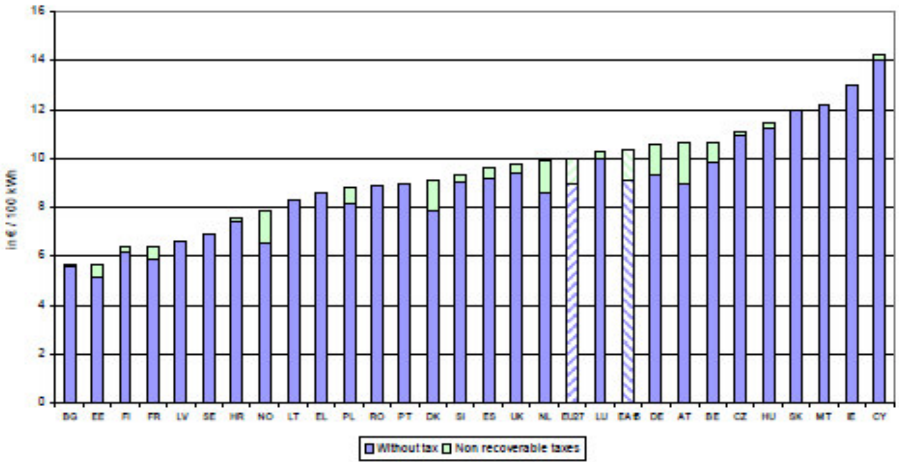
Table 1B – Electricity Prices for Household Consumers* (2008s01) in €/100kWh



Source: EC (2009)

(*)*Household consumers' refer to Consumer band Dc (annual consumption between 2500 and 5000 kWh)*

Table 2 – Electricity prices for industrial consumers* (2008 s01)



Source: EC (2009)

(*)Industrial consumers' refer to band Ic (annual consumption between 500 and 2000 MWh)

Table 3 – Unbundling of Network Operators: Gas Transmission

	GAS TSOS	
	NUMBER OF TSOS	NUMBER OF TSOS OWNERSHIP UNBUNDLED
AUSTRIA	7	0
BELGIUM	1	0
BULGARIA	1	0
CYPRUS	NAP	NAP
CZECH REPUBLIC	1	0
DENMARK	1	1
ESTONIA	1	0
FINLAND	1	0
FRANCE	2	0
GERMANY	20	1
GREECE	1	0
HUNGARY	1	1
IRELAND	1	0
ITALY	2[15]	1
LATVIA	1	0
LITHUANIA	1	0
LUXEMBOURG	1	0
MALTA		
POLAND	1	1
PORTUGAL	1	1
ROMANIA	1	1
SLOVAK REPUBLIC	1	0
SLOVENIA	1	0
SPAIN	8	1
SWEDEN	3	2
THE NETHERLANDS	1	1
UNITED KINGDOM	1	1

Source: EC (2009)

Table 4 – Broadband access by technology, July 2008

Countries	DSL		cable		Others		Total	
	lines	%	lines	%	lines	%	lines	%
Austria	1084541	**1,27**	590000	**3,58**	48730	**0,94**	1723271	**1,61**
Belgium	1379593	**1,61**	1132075	**6,88**	21685	**0,42**	2533353	**2,36**
Bulgaria	204858	**0,24**	101531	**0,62**	423984	**8,18**	730373	**0,68**
Cyprus	122129	**0,14**	1837	**0,01**	297	**0,01**	124263	**0,12**
Czech Republic	644330	**0,75**	350000	**2,13**	632000	**12,20**	1626330	**1,52**
Denmark	1246643	**1,46**	533649	**3,24**	255176	**4,93**	2035468	**1,90**
Estonia	130935	**0,15**	74532	**0,45**	111502	**2,15**	316969	**0,30**
Finland	1271496	**1,49**	212933	**1,29**	47520	**0,92**	1531949	**1,43**
France	15867461	**18,54**	750000	**4,56**	0	**0,00**	16617461	**15,50**
Germany	20226000	**23,63**	1300000	**7,90**	92300	**1,78**	21618300	**20,16**
Greece	1240148	**1,45**	0	**0,00**	5826	**0,11**	1245974	**1,16**
Hungary	789613	**0,92**	657669	**4,00**	129655	**2,50**	1576937	**1,47**
Ireland	611594	**0,71**	91462	**0,56**	138534	**2,67**	841590	**0,78**
Italy	10338972	**12,08**	0	**0,00**	388679	**7,50**	10727651	**10,00**
Latvia	170272	**0,20**	35937	**0,22**	164563	**3,18**	370772	**0,35**
Lithuania	244228	**0,29**	64626	**0,39**	237228	**4,58**	546082	**0,51**
Luxembourg	113316	**0,13**	15953	**0,10**	844	**0,02**	130113	**0,12**
Malta	41861	**0,05**	39868	**0,24**	2038	**0,04**	83767	**0,08**
Netherlands	3541300	**4,14**	2216000	**13,46**	94000	**1,81**	5851300	**5,46**
Poland	2445698	**2,86**	1104166	**6,71**	107850	**2,08**	3657714	**3,41**
Portugal	1014235	**1,18**	635229	**3,86**	22848	**0,44**	1672312	**1,56**
Romania	509791	**0,60**	508490	**3,09**	1291962	**24,94**	2310243	**2,15**
Slovakia	302270	**0,35**	55662	**0,34**	159003	**3,07**	516935	**0,48**
Slovenia	263868	**0,31**	89830	**0,55**	29823	**0,58**	383521	**0,36**
Spain	6922777	**8,09**	1735146	**10,54**	135594	**2,62**	8793517	**8,20**
Sweden	1755000	**2,05**	600000	**3,65**	604500	**11,67**	2959500	**2,76**
United Kingdom	13111769	**15,32**	3563400	**21,65**	35000	**0,68**	16710169	**15,58**
total	85594698	**100,00**	16459995	**100,00**	5181141	100,00	107235834	100,00

Source: EC (2008a).