Report on the determination of appropriate costing and pricing methodologies for the copper access network in Ireland

ComReg

Ref: 2014-10-DB-ComReg

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S.A.S. au capital de 200 000 €
RCS Paris B 394 948 731

April 2016

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1 Executive Summary

ComReg is currently reviewing Eir's obligations with respect to wholesale access to the fixed local loop. TERA Consultants has been mandated to conduct an economic study to inform ComReg's decisions. The objective of the study is to provide recommendations on the pricing and costing methodologies in relation to five wholesale access services (LLU, SLU, Line Sharing, SB-WLR and Naked DSL).

1.1 Study presentation

The document is organized as follows.

- Section 2 is an introductory section.
- Section 3 details the main characteristics of the Irish telecommunications markets and the Irish regulatory framework. It concludes on the criteria recommended by TERA Consultants to choose the most appropriate pricing and costing approach.
- Section 4 presents TERA Consultants' recommendations on the optimal pricing methodology for each service under review (i.e. retail minus *versus* cost orientation).
- Section 5 discusses the question of access price geographical de-averaging.
- Section 6 presents recommendations on costing approaches: bottom-up *versus* top-down approach, cost standard and depreciation.
- Section 7 deals with the questions of predatory pricing risks.
- Section 8 discusses in further details assumptions relevant to the implementation of the proposed cost model.
- Section 9 provides a tentative impact assessment of the proposed policy options on various stakeholders, competition and investment.

The key findings and recommendations of the report are summarised below.

1.2 Introduction and main definitions (Section 2)

Section 2 defines the main terms that will be used in the report and recalls that the objective of the study is to give recommendations on the pricing and costing methodologies relating to five wholesale access services:

1. Full LLU (Local Loop Unbundling) which allows unbundled access to the local loop.

2. SLU (Sub Loop Unbundling) which allows unbundled access to the local sub-loop.
3. Line Share which allows renting the broadband capability of a loop only.
4. SB-WLR (Single Bill Wholesale Line Rental) which allows a fixed service provider to issue one single bill to end-users for carrier pre-select (CPS) “all calls” and line rental charges and to maintain a primary relationship with the end user.
5. Naked DSL (or SABB, stand-alone broadband) which provides a standalone DSL broadband service over the Local Loop, without a Public Switched Telephone Network (PSTN) service.

1.3 Criteria to identify the most appropriate pricing and costing approach (Section 3)

As detailed in Section 3, TERA Consultants concludes from the analysis of ComReg’s statutory objectives that the criteria of choosing access pricing and costing approach depend on the characteristics of the geographic area where wholesale access services are made available.

Table 1. Criteria of choosing access pricing and costing methodology

Market	Areas with relatively high unit cost of network deployment (rural area)	Areas with relatively low unit cost of network deployment (urban area)
WPNIA	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Maintaining price stability	• Sending a correct build-or-buy signal having in mind duplication of the local loop is not necessarily desirable • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability
WBA / SB-WLR	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability	• Ensuring consistency across investment ladder • Sending a correct build-or-buy signal having in mind that use of WPNIA products by OAOs is desirable • Avoiding over-recovery of costs by Eir (not a priority if not compatible with other objectives)

Source: TERA Consultants

1.4 Pricing methodology (Section 4)

As explained in Section 4, among the different pricing methodologies available, it is recommended to apply cost orientation for all the wholesale access services. Such an approach ensures consistent treatment of different services. It implies that for SB-WLR the retail minus approach should be replaced by a cost orientation approach.

1.5 Costing methodology and price de-averaging (Section 5 and section 6)

1.5.1 General costing approach

The two general costing approaches are bottom-up and top-down approaches.

Even though cost orientation is recommended for all the services, it is recommended to adopt different costing approaches for the different types of assets. TERA recommends distinguishing between three main groups of assets:

1. passive civil engineering assets which can be reused for NGA (mainly ducts, trenches and poles),
2. other passive local loop assets (mainly copper cables and civil engineering assets which cannot be reused for NGA),
3. and finally active assets (electronic equipment such as line card and backhaul used for SB-WLR and Naked DSL services).

For each asset group, it is recommended to apply the same costing approach for all products which use this asset group to ensure consistency between products:

- Since passive civil engineering assets which can be reused for NGA are not likely to be replaced, the main regulatory principle for these assets should be to guarantee Eir's cost recovery while allowing other operators to access this non-replicable infrastructure at an efficient price level (which ensures no over-recovery of costs for Eir). The minimum price that ensures Eir's cost recovery is based on a top-down approach, reflecting Eir's costs.
- The situation is more complicated for other passive assets (i.e. copper cables). As explained in Section 3, ComReg's objectives differ depending on the geographic area. To cater for these differences, three main regulatory options ("Option 0", "Option 1" and "Option 2") are suggested in the next section.
- As regards active assets, as they are only used for SB-WLR and Naked DSL on top of the copper local loop, it is recommended to use the same approach in all options.

1.5.2 Specific price de-averaging analysis

As detailed above, other passive assets (i.e. copper cables) can be treated differently depending on the local context.

The relevant split of the national territory to assess the local context must distinguish between areas where investment in wired access network infrastructure is likely and areas it is not.

At this stage, the most relevant geographic split remains the one between Large Exchange Area (LEA) and non-Large Exchange Area (non LEA) as defined by ComReg's Decision D04/13 on bundles regulation. According to this decision, an exchange area may be qualified as LEA based on several criteria: presence of an AIP (Alternative Infrastructure Provider), presence of an OAO (Other Authorised Operator) not being an AIP, presence of Eir's NGA offer and proximity to qualifying exchanges. For the purposes of setting wholesale access prices and providing visibility to the industry, it is relevant to remove the last criterion ("proximity to qualifying exchanges" or criterion n°5) and to lock-in the actual list of exchanges (excluding criterion 5, called "Modified LEA"), as discussed at chapter 6, paras 6.38-6.40 of the ComReg report. This will provide more stability (through the "lock-in") and more consistency with the objective of incentivising investment in wired access network infrastructure where this is likely (through the removal of criterion 5). The modification of the LEA by ComReg does not affect the principles set out in this report.

In the Large Exchange Area (LEA) other local loop costs (copper cables, copper joints, civil engineering assets which require to be replaced) can be renewed or duplicated, and this is more unlikely in the non LEA. As a consequence three options are considered for the wholesale access services (i.e., LLU, SLU, SB-WLR and Naked DSL):

0 Option 0 "nationally average price" based on the whole country costs (LEA and non LEA).

1 Option 1 "nationally de-averaged price".

2 Option 2 "nationally averaged price" based on LEA costs only but where Eir's actual national costs are considered to avoid under recovery.

Option 0 "nationally averaged price" based on the whole country costs (LEA and non LEA)

The simplest and easiest way to establish the cost of each asset (reusable passive civil engineering assets and other passive assets) is to set the same price across the whole national territory based on the average cost of a line in the whole country (LEA and non LEA included).

This approach meets the requirements of the 2013 European Commission Recommendation on costing methodologies[1]: **the EC does not provide guidance on whether the cost should be calculated only in areas where infrastructure-based competition is likely to occur or for the whole territory.** In this respect, this option is consistent with the EC Recommendation.

The main drawback of this option is to raise the wholesale prices in the LEA to a non-competitive level. Moreover if this option is combined with a bottom-up valuation approach for some assets (especially the other passive assets), the national price level would be significantly higher than the full top-down cost incurred by Eir. This would preclude the achievement of the "competition" and "investment" objective for Comreg and could lead to the foreclosure of the wholesale market.

Given the reasons above, "Option 0" is not considered further in this report.

Option 1 "nationally de-averaged price"

Option 1 involves treating two areas differently: the LEA[2] (Large Exchange Areas where competition has already developed or is likely to develop, see detailed definition in Section 3.2.3) and all the other exchanges.

- The civil engineering access cost is calculated separately in the LEA and outside the LEA.
- Unlike the civil engineering assets which can be reused, the **copper cables in the LEA** are likely to be replaced by optical fibre, at least on the E-side. That is why, in these areas, OAOs should be encouraged to invest in the alternative NGA-based infrastructure. As a "too" low access charge would discourage their investments, the price should send a correct "build-or-buy" signal, so that an OAO takes an efficient investment decision. Such a "build-or-buy" signal is best ensured by adopting a **bottom-up approach,** which calculates the cost for an efficient operator investing in NGA. As indicated in Table 1, ComReg's main objectives in low cost areas include sending a correct "build-or-buy" signal, avoiding under-recovery of costs by Eir and ensuring consistency across the ladder of investment. All of these objectives are best ensured by a bottom-up approach. This is the approach recommended by the European Commission in September 2013.
- The **copper cables outside the LEA** are, in contrast, unlikely to be replaced by NGA. As shown in Table 1, ComReg's main objectives in these areas are to avoid over- or under-recovery of costs by Eir. A **top-down approach,** based on exchange lines outside the LEA, better respects these objectives.

[1] European Commission, Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment.

[2] As defined by ComReg in Decision D04/13.

Option 2 "nationally averaged price" based on LEA costs

Option 2 results in minimizing the risk of a digital divide by setting the same price across the whole national territory. This national price is equal to the average cost of one line in the LEA, with lines outside the LEA not being considered in the calculations. In fact, this approach relies on the unbundling probability of a line and is based on the assumption that lines outside the LEA are unlikely to be unbundled but also that build or buy signals are only relevant in LEA areas. Similarly to Option 1, Option 2 distinguishes between two main groups of assets: civil engineering which can be reused for NGA and other equipment (mainly copper cables), but unlike Option 1 it follows the same cost methodology for each asset in the LEA and outside the LEA.

- In contrast with Option 1, the civil engineering price is nationally calculated and based on top-down costs in the LEA to take into account the fact that only the civil engineering assets will be reused in this area.
- The situation is different for copper cables:
    - In the LEA, they are likely to be replaced, at least on the E-side. That is why a bottom-up approach is relevant, calculating the average cost of one line in the LEA.
    - Outside the LEA, where no NGA investment is likely, there is no need to calculate the replacement cost. It is thus sufficient to set the same price as in the LEA.[3] If copper cables costs were to be calculated based on the BU-LRIC cost in non LEA, the price level would be very high and would not meet Comreg's goals due to a strong over-recovery of cost (compared to top-down cost) in non LEA.
- However, under this option, for products also sold/bought outside LEA (SB-WLR, Naked DSL) where encouraging alternative infrastructure investment is less relevant, Eir should be also allowed to recover its actual top-down costs.

Similarly to "Option 0", "Option 2" is consistent with the European Commission Recommendation on costing methodologies, and is also in line with the practice of the Croatian regulatory authority (which was not opposed by the European Commission – see Commission Decision concerning Case HR/2014/1560, 5.3.2014).

The two options that are thus considered are summarised in the table below:

[3] This approach is consistent with the European Commission's September 2013 Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment and is in line with the practice of the Croatian regulatory authority (which was not opposed by the European Commission – see Commission Decision concerning Case HR/2014/1560, 2014).

Table 2. Two options studied by TERA Consultants for costing approach

Regulatory options	(Reusable) Civil engineering assets		Other local loop passive assets (i.e. copper cables)	
	LEA	Outside LEA	LEA	Outside LEA
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	Average **top-down** FAC cost of an average line **in the LEA.** Depreciation based on tilted annuity.	Average **top-down** FAC cost of an average line **outside the LEA.** Depreciation based on tilted annuity.	Price paid by alternative operators: equal to the average **bottom-up** LRIC cost (with tilted annuities) of an average line **in the LEA** paid by alternative operators	Average **top-down** FAC cost of an average line **outside the LEA**, (potentially reduced thanks to the margin generated by Eir in LEA because of bottom-up LRIC being potentially above Eir's costs)
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up	Average **top-down** FAC cost of an average line (in the LEA). Depreciation based on tilted annuity.		Average **bottom-up** LRIC (with tilted annuities) cost of an average line (in the LEA).	

Source: TERA Consultants

Finally, for both Option 1 and Option 2, active assets used by SB-WLR and Naked DSL on top of the copper local loop should be valued on a bottom-up basis of a REO operator buying LLU in LEA areas. Such an approach encourages operators to use LLU rather than relying on SB-WLR or Naked DSL. However, to make sure that prices are not excessive outside LEA where such a pricing approach (in respect of the investment ladder) is not relevant, a cost orientation approach should apply similar to that envisaged for WBA services. The cost orientation obligation should apply not only to the active assets but to the full costs of SB-WLR and Naked DSL (i.e. active assets + local loop assets). This is consistent with ComReg Decision D11/14 where Naked DSL is subject to cost orientation Outside the LEA but also subject to the national cost orientation obligation specified in D11/14. Indeed, with Option 2, the local loop costs are only based on LEA costs and therefore, for those products (i.e. SB-WLR and Naked DSL) that are also sold/bought outside LEA (i.e. in areas which can be very expensive and where "build or buy" incentives are less relevant), Eir should be allowed to recover its actual top-down costs.

Table 3. Costing approach for active assets under both options considered (relevant to SB-WLR and Naked DSL)

Regulatory options	(Reusable) Civil engineering assets	Other local loop passive assets (i.e. copper cables)	Active assets (for SB-WLR and Naked DSL)	
			LEA	Outside LEA
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	See above		Average bottom-up LRIC cost of a REO.	Floor set on the basis of the costs of buying LLU in LEA areas + national cost orientation obligation.
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up (with actual top-down cost for products also sold/bought outside LEA)				

Source: TERA Consultants

Option 1 should be preferred by ComReg if it decides that the geographically de-averaged price is acceptable, which is mainly a policy decision. This option ensures a good build or buy signal in the LEA area, and guarantees that Eir fully recover its costs in the non LEA. However, the main issue is the fact that price difference between LEA and non LEA would become very high. It should be mentioned that geographic price de-averaging has already been in place *de facto* because of wholesale price promotional discounts made by Eir in selected competitive areas (€3) but the price difference may be much greater (€5)[4]. Also, using a Top-Down approach for non-civil engineering assets in the non LEA may appear inconsistent with the 2013 European Commission's Recommendation[5] that advises using a Bottom-Up approach for non-civil engineering assets.

Since **Option 2** sets a nationally averaged price, it should be preferred by ComReg if it wants to minimise the risk of digital divide. By using a bottom-up model for non-civil engineering assets, this option also ensures that the methodology is consistent with the European Commission's recommendations. For products also sold/bought outside LEA

[4] See Table 13, there is a €5 difference between the price inside LEA with BU-LRIC with trenches and poles on TD Tilted annuities FAC (11.6) and the price outside LEA with top-down HCA FAC

[5] European Commission Recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, see Section 11.1.2 of the Annex for more details.

(SB-WLR, Naked DSL), and where "build or buy" incentives are less relevant, Eir should be allowed to recover its actual top-down costs via its wholesale price(s).

All in all, as the European commission recommendation provides only guidance to regulators, the Option 2 would be recommended as Option 1 would generate too high price differences in Ireland. If Option 2 is complemented with the ability for Eir to set SB-WLR and Naked DSL prices at a level which ensures cost recovery as explained above, the main disadvantage of Option 1 will be minimised.

Table 4. Advantages and disadvantages of the 2 options identified by TERA (relevant to SB-WLR and Naked DSL)

Regulatory options	Advantages	Disadvantages
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	• Ensure cost recovery for Eir • Send appropriate build or buy signals	• Is not fully consistent with the European Commission recommendation • Geographic de-averaging but there is already some geographic de-averaging in place • Outside LEA, SLU and duct access prices will be higher than in LEA and this could be negative for the National Broadband Plan
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up where Eir's actual top-down costs are considered for products sold/bought also outside LEA	• Is consistent with the European Commission recommendation • No geographic de-averaging • Send appropriate build or buy signals • Cost recovery is ensured for products also sold outside LEA since Eir's actual top-down costs are also considered for these products	•

Source: TERA Consultants

With respect to SLU, it is to be noted that it is relevant to consider only the cost of sub loops shorter than 1.5 km to set the SLU price. Indeed, SLU is primarily used to enhance broadband speeds using DSL technologies to NGA and NGA is available for sub loops shorter than 1.5 km. Therefore it is recommended to set the price of SLU only on the basis of the costs of sub loops shorter than 1.5 km. As it appears that the cost of sub loops shorter than 1.5 km is very homogeneous across Ireland (on the basis of the final

cost model), the question of whether SLU price should be based on national costs or LEA costs is less relevant once the cost is restrained to sub loops shorter than 1.5 km.

1.6 Potential price decrease by Eir (Section 7)

As indicated in Table 1, another important criterion for choosing the costing and pricing approach is whether it ensures price stability.

In certain geographic areas (for example, in a particular exchange), where competition from an alternative infrastructure provider becomes established, Eir may want to decrease its retail prices to be able to compete.

TERA Consultant is of the view that forbidding Eir to lower its wholesale prices would not be pro-competitive and could lead to inefficient entry (as alternative operator would receive an inadequate "build or buy" signal that could incentivise them to deploy less efficient alternative infrastructures). One could argue that ComReg does not need to introduce new rules for such cases and *ex ante* remedies are not needed. However, in a context where significant investment in NGA will happen in the coming years, it is important to provide visibility and certainty to each stakeholder, especially those that intend to deploy NGA, including Eir. Leaving such issues to *ex post* assessment could be problematic and generate uncertainty, which would then dis-incentivise investment, as *ex post* assessment can be long and complex. As a consequence, TERA Consultants believes that *ex ante* rules are required.

In such cases, Eir may be permitted to decrease access prices below the cost oriented level.

At the same time, ComReg should minimise the risk of unexpected access price changes since this may make difficult investment planning for alternative operators.

That is why introducing a "regulatory approval" mechanism is recommended, whereby Eir may ask ComReg to decrease access price in a given geographic area. To do so, Eir has to justify, using an *ex ante* margin squeeze test, that the alternative operator's retail price is non-replicable otherwise. However, the price for SB-WLR and Naked DSL Outside the LEA could not be priced below the price floor. This should prevent Eir from setting wholesale access prices too low such that they could discourage investment in LLU or other infrastructure. Eir may have to decrease the price of all the wholesale services at the same time to ensure consistency across the ladder of investment. ComReg will also consider Eir's actual local costs in this regulatory approval mechanism.

TERA Consultants believes this is a pro-competitive mechanism. Such a mechanism will maintain price stability and avoid situations where Eir makes temporary price discounts in a given geographic area in order to foreclose a competitor from the market or in order to encourage bitstream services at the expense of WPNIA services.

Detailing how the "regulatory approval" mechanism should be implemented is out of scope of this report, but ComReg could leverage on its experience with the price

regulation of bundled offers[6] that requires Eir to comply with an *ex ante* margin squeeze test.

1.7 Model implementation (Section 8)

Several recommendations are suggested for model implementation:

- The recommended timeframe for setting the access price level is 3 years which ensures a sufficient regulatory predictability.
- It is recommended to use a set of specific price trends for different cost components. Wholesale access prices should be equal to the access cost in the middle of the control period.
- For Top-Down, the standard approach where today's asset net value is equal to its accounting net book value, should be preferred.
- For Bottom-Up:
    - The “modified” scorched node approach should be used because it is based on a more achievable and realistic level of efficiency.
    - It is recommended building the BU-LRIC model based on FTTC technology and adjusting it by replacing the optical fibre elements with copper elements.

[6] Price Regulation of Bundled Offers, Further specification of certain price control obligations in Market 1 and Market 4, Response to Consultation and Decisions, Ref: Document 13/14 & Decision D04/13, 08/02/2013.

2 Introduction and main definitions

2.1 Introduction

In fixed markets, the local loop represents a bottleneck necessary to sell retail services to end-users. Since its duplication is very costly, an alternative operator (called in this report Other Alternative Operator or OAO) needs to get access to this infrastructure in order to sell services to end-users. That is why ComReg has imposed obligations on Eir to provide access to its copper local loop or part of the copper loop via several wholesale services.

Other obligations imposed concern specific conditions of access obligation, mainly transparency, non-discrimination, price control and accounting separation.

ComReg is currently reviewing Eir's obligations with respect to the wholesale access price to the local loop. TERA Consultants has been mandated to conduct an economic study to inform ComReg's decisions. The objective of the study is to give recommendations on the pricing and costing methodologies relating to five wholesale access services:

1. Full LLU (Local Loop Unbundling) which allows unbundled access to the local loop.
2. SLU (Sub Loop Unbundling) which allows unbundled access to the local sub-loop.
3. Line Share which allows renting the broadband capability of a loop only.
4. SB-WLR (Single Bill Wholesale Line Rental) which allows a fixed service provider to issue one single bill to end-users for carrier pre-select (CPS) "all calls" and line rental charges and to maintain a primary relationship with the end user.
5. Naked DSL (or SABB, stand-alone broadband) which provides a standalone DSL broadband service over the Local Loop, without a Public Switched Telephone Network (PSTN) service.

SB-WLR and Line Share are complementary services, for calls and Internet access correspondingly; they are generally bought together by OAOs. LLU, SLU and Line Sharing include renting passive equipment only, while SB-WLR and Naked DSL also include renting active equipment.

The document is organized as follows.

- Section 2 is an introductory section and defines the main terms used in the report.
- Section 3 details the main characteristics of the Irish telecommunications markets and the Irish regulatory framework. It concludes on ComReg's objectives in the context of access pricing.

- Section 4 presents TERA Consultants' recommendations on the optimal pricing methodology for each service under review (i.e. retail minus *versus* cost orientation).
- Section 5 discusses the question of access price geographical de-averaging.
- Section 6 presents recommendations on costing approaches: bottom-up *versus* top-down approach, cost standard and depreciation.
- Section 7 deals with the questions of predatory pricing risks.
- Section 8 discusses in further detail assumptions relevant to the implementation of the proposed cost model.
- Section 9 provides a tentative impact assessment of the proposed policy options on various stakeholders, competition, NGA development and on the National Broadband Plan.

In annexes, the European regulatory framework relevant for this report is summarised and further details on the different depreciation methodologies are provided.

2.2 Definitions of main terms

For consistency purposes throughout the report, the following main terms are used in this report:

- Civil Engineering Infrastructure or Assets means physical local loop facilities deployed by Eir to host local loop cables such as copper wires, optical fibre and co-axial cables. It includes, but is not limited to, underground or above-ground assets such as sub-ducts, ducts, manholes and poles.
- Exchange means an Eir network premises or equivalent facility used to house network and associated equipment and includes a Remote Subscriber Unit (RSU).
- Local Loop means the physical circuit connecting the network termination point at the subscriber's premises to the Main Distribution Frame or equivalent facility in the fixed public telephone providers' network. This is also called "Access network" or "Copper Access Network" by ComReg in its decisions.
- Main Distribution Frame is a termination point within the local exchange where exchange equipment and terminations of local loops are connected via jumper wires.
- Sub-Loop means the portion of the local loop which runs from a street cabinet or node to a home or premises.
- Next Generation Access (NGA) network means a wired access network which consists wholly or in part of optical fibre elements and which is capable of delivering broadband access services with enhanced characteristics (such as higher throughput) as compared to those provided over already existing copper networks.

- FTTN (Fibre to the Node) means an access network architecture whereby active equipment is installed in an access network node. This is a NGA network.
- FTTC (Fibre to the Cabinet) means a variant of the FTTN access network architecture where the node used to house active equipment is the street cabinet. The connection between the street cabinet and the End User premises is by way of a copper sub-loop. This is a NGA network.
- Access Services means services offered by Eir to alternative operators that grant them access to part of Eir's local loop and allow alternative operators to provide their own services to end-users. They can be provided either over current generation copper network infrastructure and its associated facilities at a fixed location or over next generation fibre network infrastructure and its associated facilities at a fixed location. They include:
    - Copper-based WPNIA (Wholesale Physical Network Infrastructure Access) services, including:
        - Full LLU (Local Loop Unbundling) which allows unbundled access to the local loop.
        - SLU (Sub Loop Unbundling) which allows unbundled access to the local sub-loop.
        - Line Share which allows renting the broadband capability of a loop only.
    - Copper-based WBA services (wholesale broadband access comprising non-physical or active network access including "Bitstream" access at a fixed location), including but not limited to:
        - Naked DSL (or SABB, stand-alone broadband) provides a standalone DSL broadband service over the Local Loop, without a Public Switched Telephone Network (PSTN) service.
    - Other copper-based services:
        - SB-WLR (Single Bill Wholesale Line Rental) allows a fixed service provider to issue one single bill to end-users for carrier pre-select (CPS) "all calls" and line rental charges and to maintain a primary relationship with the end user.
    - Fibre-based services.
- Access Prices (or wholesale Access Prices) mean prices paid by an operator for an access service offered by Eir (can be full LLU, Line Share, SB-WLR, SLU or Naked DSL).
- Copper Access Price means price paid by an operator for a copper-based access service offered by Eir (can be full LLU, Line Share, SB-WLR, SLU or Naked DSL).

In addition to this list of main terms, acronyms are defined in section 10.

3 Context

This section provides an overview of the context relevant to the study. First, a general market overview is provided outlining the market positions of different operators and the main trends. This overview will provide a basis for the analysis of possible market impacts of different access pricing regulatory options. Second, an overview of the European regulatory framework is made including a summary of the price control decisions that ComReg has already issued under the Access Regulations.[7] Third, TERA's interpretation of ComReg's regulatory objectives is discussed in the context of which costing and pricing methodologies should be assessed.

3.1 Brief Retail Market Overview

3.1.1 Market trends and main technologies used

3.1.1.1 Main figures

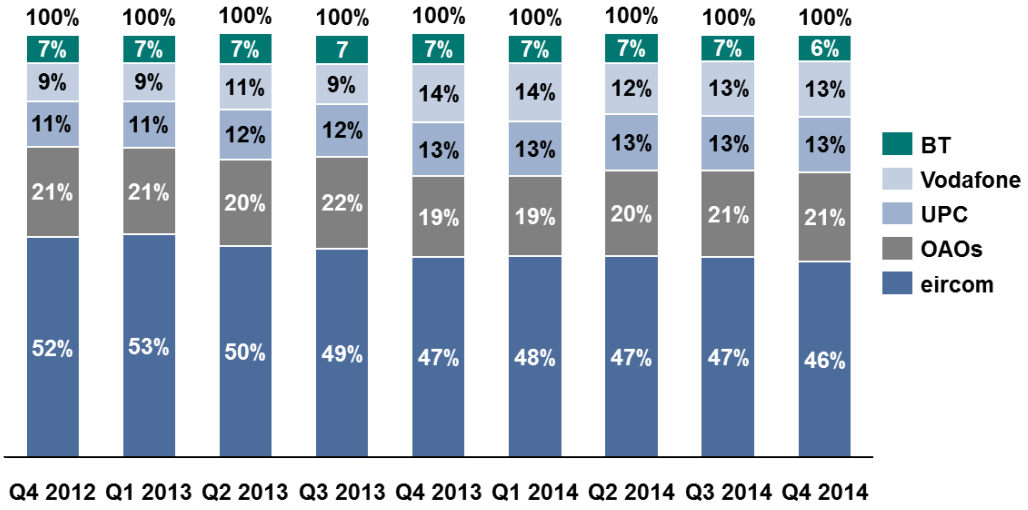
In order to understand the main trends in the Irish fixed market, this section briefly characterises the Irish competitive situation and the use of different technologies in this market. This data will be useful for the further assessment of the regulatory impact on the market. In any case, this section provides only a brief overview of the Irish markets, and is not intended to replace the Market Analysis studies conducted by ComReg.

Figure 1 below outlines the revenue shares in the retail fixed market, comprising retail narrowband, retail broadband and retail leased lines, managed and other data revenues. . In Q4 2014, Eir, the incumbent operator, had the highest retail revenue share in the market with 46.4% market share, followed by UPC (or known as Virgin Media) (13.2%), Vodafone (13.1%), BT (6.4%) and other alternative operators. Eir provides services based on its own copper access network, UPC uses its own coaxial/ hybrid fibre-coaxial network, while other operators rely largely on Eir's network.

Therefore, the market share of Eir is still very high in the retail market. This market share is even higher if only infrastructure-based competition is taken into account, which is calculated by taking the sum of Eir's retail customers and retail customers of alternative operators using Eir's local loop. On this basis Eir's infrastructure-based market share exceeds 70%.

[7] European regulatory framework is given in the annex.

Figure 1. Fixed Retail Revenue Market Shares, Q4'12-Q4'14

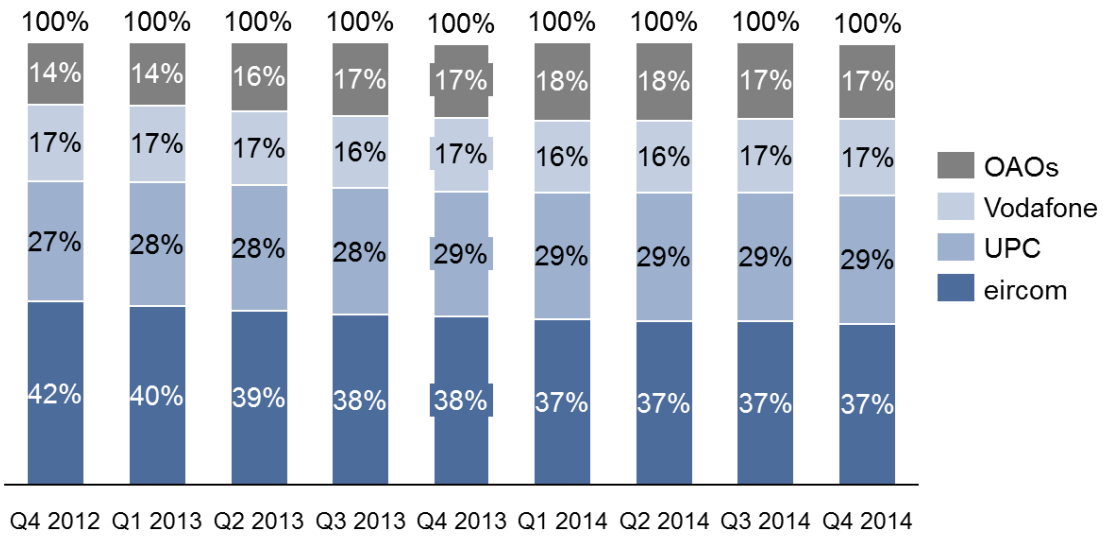


Source: ComReg, Irish Communications Market, Quarterly Key Data Report Q4 2014
Note: Comprises retail narrowband, retail broadband and retail leased line, managed and other data revenues.

Eir's market share when expressed in terms of number of subscribers in the fixed broadband market (which is the most dynamic of the fixed markets) is lower than in terms of revenues: in Q4 2014, Eir had 36.5% of total fixed broadband subscriptions, followed by UPC which had 28.9% of subscriptions. Vodafone had 17.2% (excluding mobile broadband subscriptions), Sky Ireland had 7.4%, Imagine and Digiweb had both 2%market share. It is interesting to note that Eir's market share on the retail market has stabilised since Q3 2013.

All other alternative operators (i.e. all operators except Eir, Vodafone and UPC) account for 17.3% share of fixed broadband subscriptions.

Figure 2. Subscription Market Share of Fixed Broadband Market



Source: Irish Communications Market, Quarterly Key Data Reports, Q4 2014

However, competition intensity varies depending on geographic areas:

- In urban areas, Eir faces some retail competitive pressure where UPC has upgraded its network to support NGA. Eir also faces some retail and wholesale from OAOs based on Eir's wholesale services (mainly LS) in this area;
- In rural areas, because of the high unitary costs of deploying a network in these areas, no infrastructure-based competition is likely in the medium term and OAOs are mainly buying Bitstream services from Eir. Mobile services may however generate some competitive pressure on Eir's fixed infrastructure especially as they are capable of providing voice and broadband services[8]. It is also expected the deployment of new infrastructure from the National Broadband Plan in the coming years (see section 3.1.2) will lead to an increase in competition in these areas.

Table 5 shows the total number of narrowband and broadband internet subscriptions in Ireland as of Q4 2014 by technology. At the end of December 2014, there were over 1.7 million active internet subscriptions in Ireland, 49% of which are based on the copper network (65.7% when mobile broadband is excluded), 21.5% (28.9% when mobile broadband is excluded) - on the coaxial/ hybrid fibre-coaxial cable (provided by UPC), and the rest is based on other technologies such as fixed wireless access (2.8% of total Internet subscriptions) or mobile broadband (25.4% of total Internet subscriptions).

[8] Indoor QoS is however often considered to be of lower quality than the one provided by fixed technologies.

Table 5. Total Number of Active Internet Subscriptions

Subscription Type	Q4'14 Subscriptions	% of Total Internet Subscriptions	Year-on-Year Growth Q4'13 – Q4'14
Narrowband	**6,238**	**0.3%**	**-27.2%**
DSL (Digital Subscriber Line) Broadband	630,546	37.1%	-10.1%
VDSL (Very-high-bit-rate digital subscriber line) Broadband	201,633	11.8%	+170.5%
Cable Broadband	366,554	21.5%	+7.4%
Fixed Wireless Access Broadband	48,486	2.8%	-19.8%
Other Broadband	11,539	0.67%	-3.8%
Total Fixed broadband	1,258,758	74.1%	+5.8%
Mobile Broadband	432,861	25.4%	-13.4%
Total Broadband	**1,691,619**	**99,7%**	**+0.2%**
Total Internet Subscriptions	**1,697,857**	**100,0%**	**+0.01%**

Source: ComReg, Irish Communications Market, Quarterly Key Data Report, Q1 2014

In the DSL segment (65.7% of broadband customers when mobile broadband is excluded as explained above), it is observed that:

- Eir remains the main provider of services with a share of 50.7% in terms of the number of subscribers at the end of December 2014. However, this share has decreased by 6 points over one year, while LLU lines and Bitstream has increased by 2 points and 4 points respectively.
- OAOs are mainly relying on Bitstream services (100% in rural areas, a smaller percentage in urban areas);
- OAOs are relying also on LLU in urban areas, the main form of LLU preferred being Line Share (80% of LLU lines). Out of around 1,200 exchanges in Eir's network, only 90 (mainly the largest which account for around 50% of the total number of copper lines) are unbundled. However, only half of them host at least two OAOs (which account for around 25% of the total number of copper lines)[9].

In summary, DSL access consists mainly of Eir retail DSL lines (50.7%) followed by Bitstream (36%) and LLU (13.3%).

[9] Source: ComReg file 140425_Access Request_OAO Presence by MDF.xlsx

3.1.1.2 Conclusion on market trends and technologies

- In spite of the development of service-based competition, the revenue market share of Eir at the retail level remains very high, 36.5% in terms of number of users and 46.4% in terms of revenues.
- The market position of UPC is strong with a volume market share equal to 28.9%. As UPC offers a broadband coverage to less than 50% of homes in Ireland, mostly in urban areas, the market position of UPC is very strong in urban areas.
- LLU is still low (13.3% of the total DSL access) even if the penetration of LLU within the DSL segment has grown by 2 points in one year.

3.1.2 Looking forward: NGA deployment

According to the European Commission, at the current stage of market and technological development, NGA (Next Generation Access) networks are:

(i) fibre-based access networks (FTTC, FTTN, FTTP, FTTH and FTTB[10]);

(ii) advanced upgraded hybrid fibre-coaxial cable networks; and

(iii) some advanced wireless access networks capable of delivering reliable high speeds per subscriber.[11]

Three operators – Eir, Vodafone/ESB and UPC – are currently developing or planning to develop their own NGA networks. In areas where commercial operators are not ready to deploy, the government will grant state aids aiming at NGA deployment.

3.1.2.1 Eir NGA deployment

Currently, Eir has been the major force behind the fibre network deployment in Ireland. Its NGA programme has been rolled out predominantly through the use of the FTTC technology[12].

NGA services based on Eir's fibre broadband, launched in May 2013, offer services with download speeds of up to 100Mbps by March 2014. As of end 2013, Eir's fibre network was available to 700,000 premises in major towns and cities, equivalent to 35% of all premises in Ireland. As of March 2014, the footprint is reaching 750,000 premises.

Eir plans to extend its fibre network coverage to 1.4 million premises by 2015 and to 1.6 million premises by July 2016, which represents around 70% of the country. [13]

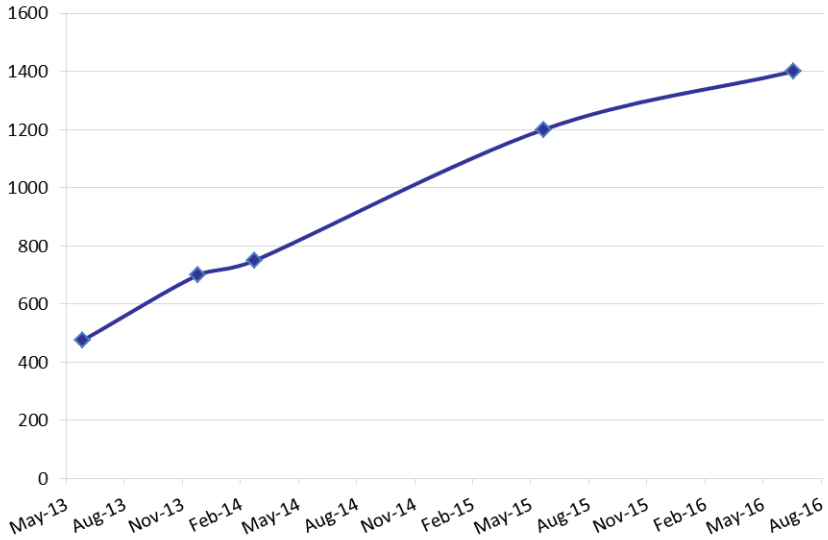
[10] Depending on the point in the network to which fibre is deployed: Fibre To The Cabinet, Fibre To The Node, Fibre To The Premises, Fibre To The Home, Fibre To The Building.

[11] Communication from the Commission. EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks (2013/C 25/01) 26 January 2013

[12] Eircom, NGA: leveraging nationwide network reach, http://www.nextgenerationnetwork.ie/ngn-access

[13] http://pressroom.eircom.net/press_releases/article/eircom_to_Offer_Gigabit_Broadband_Speeds

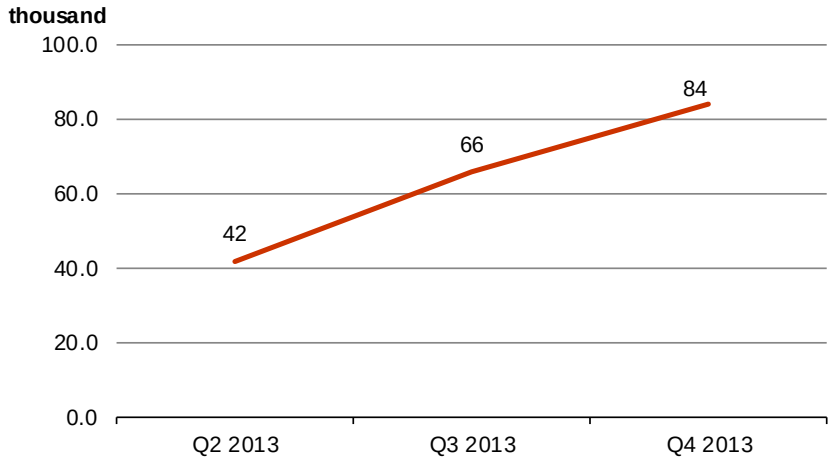
Figure 3. Eir FTTC coverage, number of premises passed



Source: Eir, Results Presentation, February 7, 2014, TERA Consultants analysis; Eir Group now has Ireland's largest fibre broadband network, 31 March 2014,

The number of fibre-based subscriptions on the Eir network reached 84,000 by the end of 2013, which is slightly above 10% of homes passed, within only 6 months of launch.

Figure 4. Eir's fibre-based subscriptions



Source: Eir

VDSL broadband services are provided to consumers by operators using three alternative methods of access. VDSL may be provided directly to the consumer by Eir using direct access to its network; this accounted for 69.5% of all VDSL subscriptions in Q4 2014. Retail VDSL may also be provided by alternative operators (OAOs) who use either wholesale bitstream, which allows OAOs to resell another operator's VDSL service, or by offering VDSL-based broadband using virtual unbundled access (VUA). Eir's market share on the VDSL platform is therefore much higher than on the DSL traditional platform (69.5% versus around 50.7% in Q4 2014).

Eir also announced in October 2014 that it will be rolling out FTTH in 66 communities in the country[14]. In June 2015, it announced that it would extend its planned fibre footprint from 1.6 million premises to 1.9 million premises (80% of all premises in Ireland) with FTTH.

3.1.2.2 UPC NGA deployment

UPC's network already covers a large proportion of the population. In summer 2010, UPC introduced the UPC Fibre Power Broadband Service, ultra-high speed internet of 100 Mbps, based on a hybrid fibre-coaxial network. By May 2010, UPC had invested over €300 million in this network, giving access to over 1/3rd of all homes in Ireland.[15]

As of the beginning of 2013, UPC contributed over €500 million in investment as part of the roll-out of its hybrid fibre-coaxial network. It offered 150 Mbps broadband speeds to 40% (800,000) of all Irish homes.[16]

3.1.2.3 Vodafone/ESB joint venture NGA deployment

The market for fibre-based broadband in Ireland may soon have another important service provider. In February 2014, Vodafone announced its plan to partner with the Irish state-owned Electricity Supply Board (ESB) to construct a new FTTH network using the latter's existing electrical infrastructure (such as poles and underground cabling). The network would be operated by a joint-venture firm, co-owned by ESB and Vodafone. The goal of the joint venture's project is to bring fibre-based broadband to 500,000 homes (outside the cities of Dublin and Cork) that have not been covered by Eir and UPC Ireland.[17] Targeted areas include Monaghan, Portlaoise, Tramore and Athlone. This FTTH network would be open on a wholesale basis to any operator that wants to sell high-speed services to regional customers.[18]

On the 2nd of July 2014 ESB and Vodafone signed an innovative joint venture agreement to invest €450 million in building a 100% fibre-to-the-building broadband network.[19]

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[14] http://pressroom.eircom.net/press_releases/article/eircom_to_Offer_Gigabit_Broadband_Speeds

[15] UPC press release. UPC unveils Fibre Power internet with up to 100Mbps, 04 May 2010 http://www.upc.ie/pdf/UPC%20unveils%20Fibre%20Power%20internet%20with%20up%20to%20100Mb.pdf

[16] http://businessetc.thejournal.ie/upc-broadband-tv-phone-subscribers-795214-Feb2013/

[17] Techweek Europe, Vodafone In Talks To Build Government-Assisted €400m Irish Fibre Network, http://www.techweekeurope.co.uk/news/vodafone-ireland-fibre-esb-government-138972

[18] ESB in talks with Vodafone on €400m fibre broadband plan, February 11, 2014 http://www.irishtimes.com/business/sectors/technology/esb-in-talks-with-vodafone-on-400m-fibre-broadband-plan-1.1686778

[19] https://www.esb.ie/main/press/pressreleaseWS.jsp?id=4074

In April 2015, the joint venture announced that 300,000 additional homes and businesses will be targeted[20].

3.1.2.4 Conclusion on NGA deployment

Extensive market investments in NGA networks are planned both by Eir and alternative operators, in particular Vodafone/ESB and UPC. Where private investments are unlikely, the National Broadband Plan will contribute to the network funding.

As retail services based on wholesale services at stake in this report (full LLU, Line Share, SLU, Naked DSL and SB-WLR) are competing with NGA, it is therefore important to make sure that copper access pricing does not deter investment in NGA or does not lead to too high levels of subsidies in the National Broadband Plan areas. This will be considered in the rest of the document.

3.2 European Regulatory Framework and national provisions

Following liberalisation of the telecommunications sector the Community Legislature adopted, in 2002, the common Electronic Communications Regulatory Framework (the "Regulatory Framework") based on five principal directives[21]. Following a review, the Regulatory Framework was further reformed in 2009. The five directives are transposed into Irish law by relevant regulations[22].

The Framework Regulations assigns a central role to ComReg in achieving the objectives of the Regulatory Framework for Ireland and in particular Regulation 16 of the Framework Regulations and Regulation 6 of the Access Regulations. ComReg's objectives and functions are also contained in sections 10 and 12 of the Communications Regulation Act 2002 (as amended)[23].

Under Regulation 8 of the Access Regulations where an operator has been designated as having significant market power on a relevant market as a result of a market analysis carried out in accordance with Regulation 27 of the Framework Regulations, ComReg can impose on such operator obligations set out in Regulations 9 to 13 of the Access Regulations as appropriate.

In particular under Regulation 13(1) of the Access Regulations, ComReg may impose obligations relating to cost recovery and price controls, including obligations for cost

[20] http://www.independent.ie/business/technology/vodafone-and-esb-unveil-fibre-broadband-service-for-cavan-31137870.html

[21] The Access Directive (Directive 2002/19/EC); the Authorisation Directive (Directive 2002/20/EC); the Framework Directive (Directive 2002/21/EC); the Universal Service Directive (Directive 2002/22/EC); and the Telecoms Data Protection Directive (Directive 2002/58).

[22] The Access Regulations (S.I. No. 334 of 2011); the Authorisation Regulations (S.I. 335 of 2011); the Framework Regulations (S.I. 333 of 2011); and the Privacy and Electronic Communications Regulations (S.I. 336 of 2011).

[23] Act No. 20 of 2002.

orientation of prices and obligations concerning cost accounting systems for the provision of specific types of access or interconnection.

ComReg is required by Regulation 30 of the Framework Regulations to take the 'utmost account' of any recommendations issued by the European Commission (under Article 19 of the Framework Directive). Furthermore, where ComReg intends to take a measure which falls within the scope of Regulation 8 of the Access Regulations it must make a draft measure accessible to the European Commission, BEREC[24] and NRAs in other Member States at the same time together with reasoning on which the measure is based[25]. NRAs, BEREC and the European Commission may make comments to the NRA concerned within one month. Article 7 (A) of the Framework Directive sets out the European Commission's procedure for assessing regulatory remedies.

When examining the appropriate costing/pricing methodologies for the local loop, TERA has considered available guidance from relevant European bodies, including the European Commission and court of justice of the European Union ('CJEU'). In this regard, the following have been taken into consideration.

Several developments happened recently in relation to costing/pricing methodologies for the local loop at the European level:

1 The Judgment of the CJEU in C-55/06 Arcor AG & Co. KG v Bundesrepublik Deutscheland [2008] ECR I-2931 (as appropriate). NB*:* this case was decided in the context of a different regulatory regime i.e. the scope of Regulation 2887/2000 but the conclusions, especially those of the Advocate General are interesting;

2 The European Commission recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA) *(2010/572/EU) (OJ L 251/35);*

3 Commission recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment (C(2013)5671 final);

4 Comment letters issued by the European Commission to other Member States under Article 7 (A) of the Framework Directive;and

The guidance referred to above and their relevance to this report are described in the annex contained in chapter 11 of the report. These sources are also referred to throughout the report.

3.2.1 Market Reviews

ComReg conducts regular market analyses which identify market failures and which conclude on the need for *ex ante* intervention. In a given relevant market, where an

[24] Body of European Regulators for Electronic Communications.
[25] Under Article 7 of Articles 7 and 7A have been transposed by Regulation 13 and 14 of the Framework Regulations 2011.

operator is found to have a Significant Market Power (SMP) position, several obligations can be imposed.

In fixed markets, the local loop represents a bottleneck necessary to sell retail services to end-users. Since its duplication is very costly, an OAO needs to get access to this infrastructure in order to sell end-users services. That is why ComReg has imposed on Eir obligations to provide access to its copper local loop or its part via several wholesale services.

Other obligations imposed concern specific conditions of access obligation such as transparency, non-discrimination, accounting separation, price control, etc.

Under the price control obligation, ComReg can impose different types of obligations among which cost orientation obligations (obligations to set prices with regards to costs) or retail minus obligations are the most widely adopted. A brief benchmark of approaches (i.e. 'cost orientation' and 'retail minus') used by other regulators confirms this and can be found in the September 2013 report of the BEREC "Regulatory Accounting in Practice 2013":

- In the WPNIA market, cost orientation is used in 90% of cases among European countries;
- In the WBA market, cost orientation is used in 50% and retail minus in 29% of cases among European countries;
- For SB-WLR, cost orientation is used in 30% and retail minus in 52% of cases among European countries.

With respect to cost orientation, according to Regulation 13 of the Regulations, ComReg may impose obligations relating to cost recovery and price controls on operators with significant market power (SMP), including obligations of cost orientation of prices and cost accounting. In this regards, Comreg should allow a reasonable rate of return on adequate capital employed taking into account the investment made by the operator and the risks involved. In this context Regulation 13(2) of the Access Regulations states that to encourage investments by the operator ComReg shall

> *"take into account the investment made by the operator and allow the operator a reasonable rate of return on adequate capital employed, taking into account any risks involved specific to a particular new investment project."*

With regards to the 5 wholesale products at stake in this report, the following obligations have been imposed by ComReg on Eir:

Table 6. Related ComReg market review decisions

Market	Last market review	Products	SMP Entity	Ex ante remedies
Market 1 Retail Fixed Narrowband Access Market	ComReg Decision D12/14 (ComReg Doc 14/89, 28 August, 2014	SB-WLR	Eir	Access obligation, non-discrimination obligation, transparency obligation, accounting separation, cost accounting and price control in the form of **retail minus obligation**
Market 2 Fixed Access Call Origination	ComReg Decision D05/15 (ComReg Doc 15/82), 24 July 2015	SB-WLR	Eir	Continuation of the retail minus control until ComReg has assessed the appropriate price control measure as part of the separate access pricing review.
Market 4 Wholesale Physical Network Infrastructure Access	Decision D05/10, 20th May 2010	LLU, LS, SLU	Eir	For current generation WPNIA: Access obligation, non-discrimination obligation, transparency obligation, accounting separation, cost accounting and price control in the form of **cost orientation obligation** and **obligation not to cause a margin/price squeeze** For next generation WPNIA: Access obligation, non-discrimination obligation, transparency obligation, accounting separation, cost accounting and price control (the form of price control was subject to further consultation, see Table 7 below)

Market	Last market review	Products	SMP Entity	Ex ante remedies
Market 5 Wholesale Broadband Access	Decision D06/11 (Document 11/49), 08 July 2011	Naked DSL	Eir	For current generation WBA: Access obligation, non-discrimination obligation, transparency obligation, accounting separation, cost accounting and price control in the form of **retail minus pricing,** Decision D01/06-Document 06/01 is maintained, and **obligation not to cause a margin/price squeeze** For next generation WBA: Access obligation, non-discrimination obligation, transparency obligation, accounting separation, cost accounting and price control (the form of price control was subject to further consultation, see Table 7 below)

Source: TERA Consultants

3.2.2 Current Access Costing and Pricing Approaches

Once the price control obligation has been selected, ComReg needs to define more precisely how it should be implemented.

The table below lists ComReg's main costing and pricing decisions:

Table 7. ComReg's main costing and pricing decisions

Product	Document	Costing/pricing approach
Products under review		
LLU	Decision D01/10 as amended D03/13	• BU LRAIC + • Tilted annuity depreciation • Nationally averaged prices • Based on exchanges that are likely to be unbundled

Product	Document	Costing/pricing approach
SLU	Decision D01/10 as amended in D03/13	• BU LRAIC +. • Tilted annuity depreciation. • Nationally averaged prices. • Based on cabinets that are likely to be unbundled.
Line Sharing	Decision D04/09	• Incremental cost methodology.
SB-WLR	Decision D07/61 as amended by ComReg Document No 08/19	• Retail minus approach (prices must be at least 14% less than the retail price charged by Eir).
SABB/ Naked DSL	Price Regulation of Bundled Offers Further specification of certain price control obligations in Market 1 and Market 4 ComReg Decision D04/13 (ComReg Document 13/14)	• Obligation not to cause a margin/price squeeze.
	Decision No D11/14	• National Cost orientation based on HCA. • Price floor to remain in the LEA (same as legacy bitstream, see below). • Retail margin squeeze test in LEA and Outside LEA. • Cost orientation obligation outside LEA[26] based on HCA for Bitstream and BMB. • Cost orientation obligation for SABB Outside the LEA.

[26] Definition of LEA is provided in the next section

Product	Document	Costing/pricing approach
Other products		
Legacy bitstream	ComReg D06/12	• BU-LRAIC+ • SEO operator with 25% market share • Limited number of exchanges assumed to be unbundled (between 100 and 150 exchanges)
	Decision No D11/14	• National Cost orientation based on HCA • Cost orientation obligation outside LEA[27] based on HCA • Obligation not to cause a retail margin squeeze in the LEA and Outside the LEA
Access to civil engineering infrastructure (WPNIA market)	ComReg Decision D03/13	• BU-LRAIC + (in accordance with the Copper Access Model): *"With regard to Civil Engineering Infrastructure (including Duct Access) <…>, Eircom shall base such charges on no more than BU-LRAIC plus costs in accordance with the Copper Access Model."* *"In order to determine a price for Access to Civil Engineering Infrastructure (including Duct Access) or Dark Fibre <…>, Eircom shall negotiate in good faith with Access Seekers in relation to the conclusion of an agreement regarding the prices for Civil Engineering Infrastructure (including Duct Access) or Dark Fibre."* • not to cause a margin/price squeeze (general WPNIA requirement)

[27] Definition of LEA is provided in the next section

Product	Document	Costing/pricing approach
Access to dark fibre (WPNIA market)	ComReg Decision D03/13	• BU-LRAIC + (in accordance with the Copper Access Model, as adjusted, where appropriate, for fibre costs): *"With regard to Dark Fibre <…>, Eircom shall base such charges on no more than BU-LRAIC plus costs in accordance with the Copper Access Model, as adjusted, where appropriate, for fibre costs."* *"In order to determine a price for Access to Civil Engineering Infrastructure (including Duct Access) or Dark Fibre <…>, Eircom shall negotiate in good faith with Access Seekers in relation to the conclusion of an agreement regarding the prices for Civil Engineering Infrastructure (including Duct Access) or Dark Fibre."* • not to cause a margin/price squeeze (general WPNIA requirement)
Unbundled access to the fibre loop (WPNIA market)	ComReg Decision D03/13	• Cost orientation *"With regard to Unbundled access to the fibre loop (including combined with GNP where required) <…>, Eircom shall ensure that the charges are cost oriented."* • not to cause a margin/price squeeze (general WPNIA requirement)
Fibre-based products of the WBA market	ComReg Decision D03/13	• No margin squeeze between end-to-end next generation bitstream and NGA bitstream: *"Eircom shall ensure that it does not create a Wholesale Margin Squeeze between <…> the price for End-to-End Next Generation Bitstream and the price for NGA Bitstream based on the NGA Margin Squeeze Model."* • No margin squeeze between NGA bitstream and VUA: *"Eircom shall ensure that it does not create a Wholesale Margin Squeeze between <…> the price for NGA Bitstream and the price for VUA (Virtual Unbundled Access) based on the NGA Margin Squeeze Model."* • No margin squeeze between VUA and SLU: *"Eircom shall ensure that it does not create a Wholesale Margin Squeeze between <…> the price for VUA and the price for SLU based on the NGA Margin Squeeze Model."*

Product	Document	Costing/pricing approach
Retail line rental	ComReg Decision D03/07	• Retail price cap remedy
Leased Lines	ComReg Decision D02/12	For the access part: • BU LRAIC approach • Allocation of civil work between copper cables and leased lines fibre cable based on the surface of cables (cross sectional approach)

Source: TERA Consultants

Legacy bitstream services, fibre-based products, leased lines, duct access and retail line rental have been included in the list of relevant costing/pricing decisions taken by ComReg and listed above for the following reasons:

- Legacy bitstream services (sometimes called Current Generation Bitstream as opposed to NGA Bitstream) are products delivered on top of the copper local loop and are therefore very similar to SB-WLR (local loop + line card) and to Naked DSL (local loop + DSLAM + backhaul + BRAS). Especially, the only difference between Naked DSL bitstream products and legacy bitstream products is the fact that Naked DSL bitstream products include the local loop access while local loop access must be purchased separately with bitstream legacy services. For the rest, the two types of products are identical. Given these similarities consistent regulation between legacy bitstream services, naked DSL bitstream services and SB-WLR may be required.

- Fibre-based access services are competing with the legacy copper services, the price difference between copper and fibre access prices should ensure efficient investment incentives to NGA.

- Ducts are an input to LLU, SLU, Line Share, SB-WLR and Naked DSL, that is why the costing/pricing approach to these services may need to be consistent with the costing/pricing approach to duct access.

- The access part of leased lines can be based on copper or fibre:

    - For leased lines based on copper, it is very important to make sure that the same methodology and inputs are used for LLU and leased lines;

    - For fibre, costs shared between fibre and copper have to be allocated to the two different types of cables.

- Retail line rental should recover the cost of the local loop (tariff rebalancing has been in place in Europe for more than 10 years[28]) and therefore the question of the consistency between retail line rental (but also of course SB-WLR) is relevant.

3.2.3 Geographically differentiated remedies in Ireland

ComReg's Decision D04/13 splits margin squeeze methodologies between Large Exchange Areas (LEA) and non LEA areas which have different competition dynamics.

According to this decision, an exchange area may be qualified as LEA based on several criteria:

- presence of an AIP (Alternative Infrastructure Provider),
- presence of an OAO not being an AIP,
- presence of an NGA offer or proximity to an exchange already included in LEA areas.

More precisely, LEA comprises individual exchange areas each of which satisfies at least one of the following criteria:

1. At least one AIP (Alternative Infrastructure Provider) and at least one OAO (Other Authorised Operator) (not being an AIP) is providing telecommunications services at the retail level using LLU or VUA (directly or indirectly), subject to the condition that they, all taken collectively, have a reasonable market share and reasonable market coverage in the relevant exchange area.
2. At least two OAOs (not being AIPs) are providing telecommunications services at the retail level from the relevant exchange using LLU or VUA (directly or indirectly) - subject to the condition that they, taken collectively, have a reasonable market share and reasonable market coverage in the relevant exchange area.
3. An exchange area in which:
    a. at least one AIP is providing telecommunications services at the retail level to end-users; and
    b. Eir and OAOs relying on wholesale inputs from Eir are providing retail fixed broadband services to less than 20% of the premises in that exchange area,

[28] Tariffs are said to be "rebalanced" as a clear consequence of the liberalisation of the fixed telephony market in the EU15 countries since 1998: *"Under the legal monopoly, operators used to cross-subsidise low retail subscription fees with high call charges. However, according to the Full Competition Directive and the Voice Telephony Directive, tariffs for voice telephony services offered by dominant operators have to be cost-oriented"* (http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/00/480&format=HTML&aged=0&language=EN&guiLanguage=en).

c. subject to the condition that the said AIP(s) must, taken collectively, have a reasonable market share and reasonable market coverage in the relevant exchange area;

4. An exchange area in respect of which Eir has provided at least six months prior notification regarding the launch of NGA services by Eir in cabinets in the relevant exchange area, subject to the condition that those proposed NGA-enabled cabinets must serve at least a reasonable number of lines in that exchange area;
5. Exceptionally, and subject to case-by-case assessment by ComReg, an exchange area in which the relevant exchange:
    a. Is surrounded by Qualifying Exchanges; or
    b. Serves fewer than 500 residential premises and is located either adjacent to, or in reasonable proximity to, Qualifying Exchange(s); or
    c. Is determined to have an economic affinity with adjacent Qualifying Exchange(s), subject to the total residential premises served by Qualifying Exchanges under this sub-criterion 5(c) not exceeding 5% of the total residential premises in the Larger Exchange Area (excluding those residential premises which are served by Qualifying Exchanges under sub-criterion 5(b) above).

Conclusion

ComReg's approach to apply different regulatory approaches in LEA and outside LEA is specific to Ireland and represents key aspects of the competitive framework in Ireland.

3.3 Defining criteria used to choose the most appropriate pricing and costing approach

ComReg's objectives and functions are set out in Regulation 16 of the Framework Regulations, Regulation 6 of the Access Regulations and in sections 10 and 12 of the Communications Regulation Act 2002. It should be noted that there is significant overlap between the provisions contained in the Access and Framework Regulations with those set out in the Communications Regulation Act 2002.

Regulation 8 of the Access Regulations also requires that where an SMP obligation is imposed that it is based on the nature of the competition problem identified and is proportionate and justified in light of the objectives laid down in section 12 of the Communications Regulation Act and Regulation 16 of the Framework Regulations.

Furthermore and of particular relevance to this report, Regulation 13 of the Access Regulations allows ComReg to impose price control obligations. When considering the imposition of such obligations ComReg must take into account the investment made by the operator which it considers relevant and allow the operator a reasonable rate of return on adequate capital employed, (taking into account any risks involved specific to

a particular new investment network project)[29]. ComReg must also ensure that any cost recovery mechanism or pricing methodology that it imposes serves to promote efficiency and sustainable competition and maximise consumer benefits[30]

When reaching any decision ComReg is required to consider each of its objectives and must not act in any way that conflict with those obligations. While no particular objective can be considered more important than another ComReg may, given the context of the decision, need to balance these goals and place a greater emphasis on one or more of these. While also considering the other two objectives, the objective of promoting competition is considered by TERA Consultants to be the most relevant in the context of access regulation. As this report focuses on the further specification and / or amendment of price control obligations to address specific competition problems the second and third objectives are thought to be of less relevance as they relate more the promotion of the internal market and consumer welfare issues (which appear to be indirectly, rather than directly, affected by its contents).

Thus it is TERA's view that the three main goals of access regulation are **competition, investment, and end users.** These objectives are further described below in the context of copper access network costing/pricing and are then transposed into more precise objectives for the determination of appropriate costing and pricing methodologies for the copper access network in Ireland.

3.3.1 "Competition" objective

Competition objective consists of "*ensuring that there is no distortion or restriction of competition in the electronic communications sector*".

With respect to the competition objective, a trade-off should be made between promotion of competition in the short term, in the average term and in the long term. Infrastructure-based competition, when each competitor constructs its own local loop, provides the OAOs with more freedom even in the absence of access regulation. However, it requires a lot of investment to duplicate infrastructures in their entirety, thus this option will rarely be chosen by OAOs in the short to average term. There is also a debate on whether this is desirable for the society but also whether this is feasible in the longer term to have several local loops in parallel given the lower economies of scale and scope (and therefore higher costs translated into higher prices) generated by the presence of competing local loops.

[29] Paragraph 13(1) and (2) of the Access Regulations.

[30] Paragraph 13(3) of the Access Regulations.

Service-based competition[31], when OAOs use different access services, is more likely to develop in the short and average term. More specifically, competition based on WPNIA is more beneficial than competition based on bitstream services: bitstream offers less differentiation in terms of price and of product for OAOs.

In order to promote competition in the short term, ComReg should ensure that the difference between wholesale access prices and retail prices is not too low (otherwise a margin squeeze may occur whereby OAOs cannot be profitable given a relatively "too high" access price compared to a relatively "too low" retail price set by the incumbent). However, a "too low" access price (bitstream, SB-WLR, LLU/SLU/VUA) may deter investments in the long term:

- If bitstream or SB-WLR price is "too low" compared to LLU, OAOs will not upgrade their network to reach exchanges and benefit from LLU (issue related to the "ladder of investment", see section 3.3.2)
- If (copper) LLU/SLU/VUA[32] is "too low", OAOs may not have sufficient incentives to invest in NGA networks.

All in all, in order to promote competition in the long term, ComReg should strike a balance between two objectives:

1 Ensuring that the wholesale access price is not "too low", otherwise alternative operators would prefer to stick with access services instead of developing their own network.

2 Ensuring that the access price is not "too high" to avoid that competition distortion in favour of the SMP operator (which should not be over-compensated for its investments by over-recovering its costs through the "too high" access price).

3.3.2 "Investment" objective

Encouraging efficient investment in infrastructure is a rather complex objective. It is described below from several angles.

3.3.2.1 Investment incentives of alternative operators: build-or-buy signal

ComReg's competition objective and investment objective are connected: service-based competition requires less investment compared to infrastructure-based competition. It means that, in order to respect the investment goal, infrastructure-based competition is preferable under the condition that investment in the new network is at least as efficient as in the current network.

To ensure this condition, access price should be equal (or close) to the annualized cost of deploying a new efficient network. Indeed, in this case, if an OAO is able to construct

[31] Competition with OAOs using LLU or SLU is sometimes referred as "infrastructure-based competition" because OAOs are required to build a significant network to reach the exchanges or the street cabinet. However for the purpose of clarity this report defines "infrastructure-based competition" as a situation where an OAO has deployed an alternative local loop reaching the premises of the end-user (such as an OAO deploying an NGA network reaching the premises of the end-user).

[32] LLU and SLU and VUA FTTC prices are closely related because they share a large amount of same costs.

its own network that is at least as efficient as the theoretical "new efficient network", it will prefer to do so instead of using access services. Otherwise, when the OAO is unable to do so, it will prefer using access services. As such, the OAO makes an economic decision to construct a new network whenever it is rational to do so from both the OAO and industry point of view.

This pricing principle sends a correct "build-or-buy" signal. As the bottom-up approach considers the costs of purchasing assets today (cf. section 6.1.1), it effectively mimics the conditions that would be faced by a new entrant. The access prices are neutral for an alternative operator: buying the wholesale product or deploying its own network represents then two economically equivalent options.

3.3.2.2 Investment incentives of alternative operators: the ladder of investment principle

Access services constitute a ladder of investment for an alternative operator: different access services serve as steps on this ladder.[33] As building its own network requires significant investment, full scale infrastructure-based competition is unlikely to develop in the short or average term. For an OAO, it is easier to start with service-based competition, in order to initiate investing, to test consumer demand and to study market risks. Once this is done, an OAO may move to the next step on the ladder. At this stage an OAO may start selling services based on SB-WLR and Bitstream, investing in the core network and marketing department, and growing its client base. Once the first level of investment is made, an OAO may pass to the next step on the ladder (LLU or Line Sharing or VUA) and invest in active equipment in the local loop. Then, an OAO may invest in its own FTTC network and start using SLU, and finally, in the long term, it may construct its own (fibre) local loop.

The link between competition and investment by alternative operators is presented in the table below:

[33] Cave, Martin. "Encouraging infrastructure competition via the ladder of investment." Telecommunications Policy 30.3 (2006): 223-237.

Table 8. Possible market configurations in a given area

Competition	Investment by alternative operators	Assessment
No competition	No investment	Configuration unfavourable both for competition and for investment by alternative operators, needs to be avoided to the extent that a regulatory intervention can locally improve competition dynamics
Service-based competition using SB-WLR and Naked DSL	Investment in the core network ("Step 1" of the ladder of investment)	Configuration likely to occur on a national scale.
Competition using LLU and Line Sharing (or VUA)	Investment in the core network and in the active local loop equipment ("Step 2" of the ladder of investment)	Configuration beneficial both to competition and investment, most likely to occur in dense areas (LEA). **Several parallel competing (backhaul) infrastructure are desirable** as observed in other European countries
Competition using SLU	Investment in the core network, in the active local loop equipment and in fibre cables between exchange and street cabinet ("Step 3" of the ladder of investment)	Configuration beneficial both to competition and investment, most likely to occur in dense areas (LEA). However, **it is not clear whether competition is achievable in this step of the ladder of investment**. Indeed, because of the size of street cabinets (i.e. number of customers served by a unique street cabinet), the first operator installing equipment at the street cabinet (almost always the incumbent – except in NBP areas) remains dominant. Also, the vectoring technology requires the presence of a unique operator at the street cabinet
Infrastructure-based competition	Investment in the core network, in the active local loop equipment and in the physical parts of the local loop ("Step 3" of the ladder of investment) – **except for ducts, trenches and poles that can be reused from Eir's network (or other infrastructure access providers such as the electricity network).**[34]	Configuration more likely in the long term and unlikely in the short and average term since one-off investment level can be very high. The local loop is considered as a natural monopoly. **Duplication of the local loop is therefore not always desirable or feasible.** However, investments to replace the local loop are desirable.

Source: TERA Consultants

For the same level of competition, it is preferable to choose a higher level of investment in order to "climb" the ladder of investment.

[34] For certain assets duplication is not economically rational. It is impractical for alternative operators to build another network of ducts and trenches next to the incumbent's existing network when the existing network still has spare capacity for more cables. Ducts and trenches create a bottleneck, where new entrants cannot realistically replicate the network of the incumbent. In this case, alternative operators can buy access to the

Access prices should be set in such way that alternative operators are able to make an efficient decision on whether to build their own network or to use one of the access services (see section 3.3.2.1). Similarly, they should make an efficient decision on which service to use.

A right balance should be found between incentivising today's competition and incentivising large-scale investments in the network in the long term. The Access Directive highlights the need to consider both of these objectives: *"the imposition by national regulatory authorities of mandated access that increases competition in the short-term should not reduce incentives for competitors to invest in alternative facilities that will secure more competition in the long-term".*[35] Competition means lower retail prices for both legacy and NGA-based services, since they are often seen as substitutes, and lower retail prices mean lower incentives to invest for operators.

The priority between short-term and long-term investments may vary depending on the specific conditions of each wholesale product and geographical area (competition level, technical and economic viability of using or installing competing facilities):

- Where the average per-customer cost of constructing a network is high[36], neither infrastructure-based competition nor LLU-based competition is likely to develop. Indeed, it takes too much time for a private investor to make a profit on the investment in the network knowing that prices at the retail level are constrained by customers' ability to pay. In this case, the local loop represents a bottleneck; service-based competition based on SB-WLR and Naked DSL should be the main priority (no build-or-buy signal is needed). This is often the case in rural areas.
- In urban areas and large exchanges that are more profitable, alternative operators are more likely to invest in the infrastructure: that is why in these areas it is important to incentivise usage of LLU, SLU and Line Sharing, and encouraging infrastructure-based competition should be a priority.

In summary several forms of competition need to be encouraged by ComReg: infrastructure-based competition (UPC and potentially Vodafone/ESB), competition relying on LLU, LS and SLU services, and service-based competition relying solely on Eir's copper local loop (WBA and SB-WLR). However, this remains true only in the most urban areas.

In rural areas, infrastructure-based competition as well as competition relying on LLU, LS and SLU are very unlikely (after more than 10 years of regulation, they have not

incumbent's network to compete in downstream markets. Alternatively, a new entrant can buy access to other existing infrastructures, such as electrical poles. For these assets, the investment goal is less relevant.

[35] Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive) as amended by Directive 2009/140/EC

[36] Which is the case in remote areas where there are few customers linked to an exchange.

developed at all[37] and this is also why the Irish National Broadband Plan aims at bringing NGA infrastructure to these areas with public subsidies) and only service-based competition relying on WBA or SB-WLR is likely.

3.3.2.3 Investment incentives of OAOs: access price stability

To be able to make investment business plans, alternative operators need to have significant visibility regarding future wholesale prices. A business plan's profitability essentially depends on wholesale access prices paid to the SMP operator, even if an OAO does not use the SMP operator infrastructure (as the SMP wholesale access prices constitute a reference for the market). For example, if the current access charge is below the maximum allowed regulated access price (e.g. "price cap"), an alternative operator does not know whether this price level will be maintained or whether the SMP decides to increase the price in the near future (while still being less or equal than the "price cap"); such uncertainty jeopardises the investment profitability by increasing the business risk for OAOs.[38]

3.3.2.4 Investment incentives of the SMP operator

Investment incentives for the SMP operator should not be ignored.

In order to maintain these incentives, it is necessary to ensure that the SMP operator recovers at least its costs through the wholesale access prices: otherwise there is a real risk that the SMP operator will stop maintaining its copper network.

The rational for investing in NGA for the SMP operator also depends on the copper access price. In principle, in cases where the copper access price (whether for WPNIA-services, SB-WLR or Naked DSL) is "high", the competitive pressure on lowering retail price will be low because the copper access price is an important input for OAOs. Consequently, the profitability of NGA's investments increases for the SMP operator. In addition, the incumbent is (generally) more likely to benefit from the financial means to invest in a FTTC/FTTH network. It is especially relevant in areas where no competition from an alternative infrastructure is present.

3.3.2.5 Technological neutrality

Investment by OAOs and NGA investment by the SMP operator lead to technological improvement of the network, thereby promoting innovation, which is a part of ComReg's "investment objective" as stated in the Communications Act (§12.2).. Investment by OAOs allows the deployment of new efficient equipment embedding the latest technological developments. Additionally, the SLU service is very important since it

[37] For example, at the end of 2013, the number of full LLU lines was only 15,640, and the number of shared LLU lines was 64,397, which in total corresponds to only 11.4% of the provision of DSL Access, compared to 32.3% for wholesale bitstream lines. (ComReg. Irish Communications Market. Quarterly Key Data Report. Data as of Q4 2013)

[38] During meetings with ComReg and TERA, alternative operators expressed concerns about temporary access price discounts made by Eircom.

allows alternative operators to install fibre cables between the exchange and street cabinet, so that the transition from the current generation network to the NGA network is incentivised. The copper network will be gradually replaced by the fibre network on the E-side. ComReg should ensure the efficient transition towards this next generation technology.

At the same time, as stated in the Communications Act, ComReg has to take the utmost account of the desirability that the measures taken do *"not result in discrimination in favour of or against particular types of technology" (§12.6)*. This means that regulation should not prevent operators from choosing the most efficient technology (as long as the investment in a new technology is made only when such investment is justified and is compensated by increased efficiency).

3.3.3 "End-user" objective

Finally, the third goal of access regulation, together with competition and investment, is to promote the interests of end users: they should derive maximum benefit in terms of choice, price and quality. If regulation encourages competition, efficient investment and new technology, as described above, it will automatically ensure better quality, lower prices and a larger consumer choice. This way, consumers' interests are promoted. Competition based on Naked DSL and SB-WLR gives more immediate effects than competition based on LLU, SLU and Line Sharing. However, development of Market 4 services and corresponding investments are more beneficial to end users in the long term because they facilitate OAOs to better differentiate themselves from the SMP operator. There is a trade-off between lower prices and better quality due to more investment: operators are ready to invest only under the condition that the retail price is not too low.

However, a too high access price could have two negative aspects for end-users:

- First, it may impact retail prices and prevent some end-users from getting access to the network;
- Second, it may encourage inefficient duplication of the local loop which may be translated into higher retail prices in the long term because the economies of scale on each local loop would be smaller.

3.3.4 Conclusion on Criteria Used to Determine the Optimal Access Pricing and Costing Approach

The general objectives described above transform into the following criteria of choosing appropriate costing and pricing methodologies for the copper access network in Ireland.

With respect to the competition objective, ComReg should ensure that:

- The access price is not "too high" in areas where the deployment cost for each line is high (such as in rural areas) and consequently the infrastructure-based competition is unlikely to develop. Service-based competition should thus be promoted.

- However, in other areas where deployment cost is lower for each line (such as in urban areas), the access price should not be "too low" in order not to deter investments in the long term (with the objective to promote infrastructure-based competition).

In order to avoid competition being distorted in favour of Eir, ComReg should ensure that Eir does not over-recover costs through the wholesale access price.

The same principle holds for the investment objective: a correct build-or-buy signal should be sent in those areas where new infrastructure investments are likely. Such a build-or-buy signal should encourage operators to invest in NGA technology whenever this is efficient. Prices of different wholesale services should be consistent in order for the ladder of investment to work.

It is also important to ensure price stability in order to avoid deterring investments by alternative operators: if alternative operators face significant wholesale price uncertainty, they will be reluctant to deploy alternative infrastructure given the risk posed on the profitability of their investment. Indeed, for an operator deploying an NGA network such as Vodafone/ESB or upgrading its existing network to NGA such as UPC, the expected profitability of the investment and the operator's business plan will be significantly affected if the wholesale access price to the largest competing platform in Ireland is unstable.

With respect to the end-user objective, this principle is similar to the competition and investment objectives since end-users benefit from stronger competition and investments. In conclusion, the objectives of ComReg in the context of access pricing transform into the following criteria:

- Sending a correct build-or-buy signal[39]:
    - In rural areas, this criterion is not relevant because OAOs are unlikely to buy anything other than bitstream and/or SB-WLR and there is no available alternative infrastructure,
    - In urban areas, this criterion should be interpreted differently at the different levels of the investment ladder:
        - SB-WLR and Naked DSL (but more generally all bitstream services) prices should be set to make sure the incentive to deploy alternative (backhaul/active) infrastructure ("build") is encouraged;
        - LLU (LS and full LLU) and SLU prices (but also duct access) should not deter investment in alternative local loop. However, the facts that duplication of the local loop and presence of several

[39] The build-or-buy criterion is also often put forward by the European Commission when assessing NRA's notifications in relation to costing/pricing methodologies for the copper local loop (see Annex, 11.1.4).

operators at a street cabinet is not always desirable/feasible as explained above (due to the lack of economies of scale) and that alternative local loops (based on alternative technologies) are already in place should be taken into account to avoid over-encouraging the “build” strategy.

- Avoiding under-recovery of costs by Eir,
- Avoiding over-recovery of costs by Eir, especially in rural areas where Eir’s local loop and Eir’s core network are likely to be the only fixed networks available. In urban areas, Eir is constrained at the retail level by alternative infrastructure operators.
- Ensuring consistency across the investment ladder,
- Maintaining price stability.

A trade-off between these criteria needs to be made since all of them are difficult to achieve at the same time. The priority of criteria depends on the characteristics of particular assets and geographic areas:

- Where no infrastructure-based competition is likely to develop (a high cost of network deployment), there is no need to send a correct build-or-buy signal. The costs that were actually incurred by the owner of the bottleneck, including the extent to which those access assets have already been recovered by way of depreciation to avoid over- or under- recovery of cost, are more relevant than the costs that would be faced by a new entrant.
- Where the infrastructure-based competition has developed or is likely to develop, avoiding under-recovery by Eir remains important. However, other objectives are added: sending a correct build-or-buy signal and maintaining consistency across the ladder of investment. The correct build-or-buy signal, together with avoiding cost under-recovery are the main objectives.

Maintaining price stability is important for the whole national territory.

These criteria are summarized in the table below:

Table 9. Criteria of choosing access pricing and costing methodology

Market	Areas with relatively high unit cost of network deployment (rural area)	Areas with relatively low unit cost of network deployment (urban area)
WPNIA	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Maintaining price stability	• Sending a correct build-or-buy signal having in mind duplication of the local loop is not necessarily desirable • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability
WBA / SB-WLR	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability	• Ensuring consistency across investment ladder • Sending a correct build-or-buy signal having in mind that use of WPNIA products by OAOs is desirable • Avoiding over-recovery of costs by Eir (not a priority if not compatible with other objectives)

Source: TERA Consultants

This analysis raises the question of how to identify and define rural areas on the one hand and urban areas on the other hand. Here, urban areas are defined as areas where investment in wired access network infrastructure from private operators is possible and where it is relevant to incentivize such investment. It is therefore important to make sure no investment in rural areas is likely to happen from private operators. It is noted that such an identification of areas where investment in broadband networks from private operators on their own is unlikely to happen must be conducted by any Member State in the context of National Broadband Plan[40]. This will therefore be conducted in Ireland. This is further discussed in section 5.2.

[40] EU Guidelines for the Application of State Aid Rules in Relation to the Rapid Deployment of Broadband Networks (2013/C 25/01): *"Public consultation: Member States should give adequate publicity to the main characteristics of the measure and to the list of target areas by publishing the relevant information of the project and inviting to comment. A publication on a central web page at national level would in principle ensure that such information is made available to all interested stakeholders. By also verifying the results of the mapping in a public consultation Member States minimise distortions of competition with existing providers and with those who already have investment plans for the near future and enable these investors to plan their activities"*

4 Recommendations on the pricing methodology

4.1 Defining possible pricing methodologies

For each of the wholesale access services under price control obligation, ComReg needs to determine the form of price control.

If it is decided to set a regulated access price, two broad pricing methodologies[41] exist:

- Retail minus when access prices are set on the basis of the end-user prices of the corresponding final services;
- Cost orientation when access prices are set on the basis of the cost of providing the services.

There are other methodologies available such as benchmarking but benchmarking is rarely considered as a relevant methodology since it makes it difficult to take country specificities into account.

According to the September 2013 report of the BEREC "Regulatory Accounting in Practice 2013", retail-minus and cost orientation are the main methodologies used by NRAs in the markets at stake:

- In the WPNIA market, cost orientation is used in 90% of cases among European countries[42];
- In the WBA market, cost orientation is used in 50% and retail minus in 29% of cases among European countries[43];
- For SB-WLR, cost orientation is used in 30% and retail minus in 52% of cases among European countries[44].

It is important to note that setting a regulated access price using retail-minus or cost orientation may be combined with the obligation not to cause a margin squeeze. *Ex ante* margin squeeze obligations are generally imposed by NRAs, and it is already the case in Ireland where several types of margin squeeze obligations are imposed on Eir by ComReg (see sections 3.2.2 and 3.2.3).

- On the one side, it should be checked that the economic space between a wholesale access price and the corresponding retail price is sufficient so that an efficient alternative operator is capable of providing its services.

[41] Other approaches may be considered, such as benchmark (the access prices are set based on international comparison) or a Ramsey pricing approach, but these approaches should be avoided since they are less precise (benchmark) or are impractical (Ramsey pricing).

[42] The updated report for 2014 gives a value of 70%

[43] The updated report for 2014 gives a value of respectively 56% and 30%

[44] The updated report for 2014 gives same values

- On the other side, it should be checked that the economic space between two services is sufficient so that alternative operators "climb" the ladder of investment.

A detailed study of margin squeeze obligations is not the core subject of the current report but is however discussed in section 6.3.2.3.

4.2 Recommendations for WPNIA products

On Market 4 (WPNIA), cost orientation is the most used methodology in Europe and has been the methodology used by ComReg until now. Indeed, full LLU, Line Share and SLU are essential inputs for OAOs and for their investors as they represent a key element to build business cases.

If a retail-minus approach is used for these products, it will not provide stability to investors since any movement at the retail level will be transposed to the wholesale level. Also, it may provide a too high margin to Eir for such products in those areas where no competitive infrastructure is present and therefore Eir has more freedom to set its prices at the retail level.

In contrast, cost orientation allows the prices of these products to be set based on (efficiently incurred) underlying costs and therefore enables OAOs and investors to make relevant choices (build or buy choices). Also, this methodology avoids over-recovery and under-recovery of costs by Eir. Finally it provides more stability to stakeholders.

Therefore, the **cost orientation** approach applied to WPNIA products is better aligned with ComReg's objectives. However, as it will be explained in section 7, this methodology may need to be complemented by other mechanisms.

4.3 Recommendations for SB-WLR and Naked DSL

The retail minus approach is broadly used for services that include renting active equipment from the SMP operator and so require less investment from alternative operators. Such services are "closer" to retail services.

Consequently, for SB-WLR and Naked DSL, both pricing approaches are applicable, and there is a need to define the most efficient one. The choice should be made with respect to ComReg's objectives. As explained in 3.3, ComReg's objectives in the context of access pricing include competition, investment and end user interests.

4.3.1 Arguments in favour of retail-minus

On the one hand, two arguments are in favour of a retail-minus approach:

1 First, since SB-WLR is currently priced on a retail-minus approach, choosing this approach would provide regulatory consistency. Regulatory consistency is important since it provides operators with a long-term vision and so facilitates planning investments.

2 Second, an advantage of the retail minus approach is its ease of implementation: there is no need to build a cost model. In addition, more data is needed to construct a cost model than to set access prices based on retail minus approach. However, in our case it does not apply since the model will be built in any case for Market 4 (WPNIA) services, it will only be needed to extend it to calculate costs of SB-WLR and Naked DSL. All the necessary data will be collected for the purpose of Market 4 (WPNIA) costing. Also, ComReg has already developed a WBA cost model.

4.3.2 Arguments in favour of cost orientation

On the other hand, five arguments are in favour of a cost orientation approach:

1 First, using the same pricing approach (cost orientation) for all the services (LLU, SLU, Line sharing, SB-WLR and Naked DSL) provides more consistency across the investment ladder. Potential discrepancies could favour, for example, the use of Naked DSL against LLU or SLU, and so would prevent an alternative operator from climbing the investment ladder. For example, if the retail naked DSL is equal to €20 and LLU is equal to €10 and applying the retail minus approach leads to wholesale naked DSL equal to €15, by decreasing retail naked DSL to €15, the SMP operator could foreclose LLU operators (and then could later increase retail prices). This argument is less relevant in rural areas where LLU is unlikely. However, in rural areas, Eir could set excessive retail and therefore wholesale prices.

2 Second, by definition the strict recovery objective is better ensured when the cost orientation approach is chosen.

3 Third, the chosen approach should ensure that the access price is not too high, so that competition may develop and a correct build-or-buy signal is sent. This condition holds automatically for cost orientation, while under retail minus the access price may be too high if the retail price is high. This can occur in areas where no competition from alternative infrastructure providers is present. In Ireland it is relevant outside the LEA. However, in areas where competition on the retail level is sufficient, a retail minus approach can suffice.

4 Fourth, the chosen pricing method should ensure predictability of access price levels for alternative operators. Otherwise they cannot invest. Cost orientation better meets this criterion because the retail-minus methodology links wholesale prices and retail prices and the latter can vary often.

5 For legacy bitstream services, ComReg has recently moved to a cost orientation obligation, especially to avoid excessive prices in rural areas. Therefore setting SB_WLR price on a cost oriented basis would ensure greater consistency across the narrowband and broadband product portfolios.

6 Finally, Naked DSL is already subject to cost orientation Outside the LEA (see ComReg Decision D11/14).

4.3.3 Conclusion and recommendation

The table below compares cost orientation and retail minus for SB-WLR. It suggests that cost orientation is today the best approach for both services. Cost orientation is already the approach imposed by ComReg Outside the LEA for Naked DSL.

This does not imply that retail minus was not relevant in the past for SB-WLR: as the wholesale market was emerging, the problem of the ladder of investment and pricing consistency between services was less acute. In addition, cost modelling remains a complex task that requires accumulating some significant experience, which is now the case for ComReg.

Table 10. Comparing cost orientation and retail minus approach applied to SB-WLR

Criterion	Cost orientation	Retail minus
Maintaining price stability / Regulatory continuity	×	✓
Consistency across investment ladder	✓	×
Avoiding cost over-recovery	✓	×
Avoiding cost under-recovery	✓	×
Sending a correct build-or-buy signal	✓	×

Source: TERA Consultants

The **cost orientation** approach applied to all the services under review better aligns with ComReg's objectives. However, the cost orientation methodology needs to be further specified to make sure access prices do not discourage operators to buy WPNIA products (see section 6.3.2.3).

4.4 Recommendations for ancillary services

In addition to the main access services, Eir also has to provide ancillary services, such as services related to connections, disconnections and migrations (for example from bitstream to Line Share or LLU and from Line Share to LLU).

Other services are related to customer services, such as voicemail box or temporary off service. Some of these services are difficult to replicate by an alternative operator, but are necessary to provide a retail service.

There are numerous ancillary services linked to different wholesale offers (such as LLU or SB-WLR). Prior to ComReg Decision D05/15 (Document 15/82) the pricing of ancillary services for SB-WLR was established by way of a retail-minus approach[45]. A cost

[45] See ComReg D07/61

orientation approach has been in place to date for ancillary services for LLU, LS and SLU.

During their meetings with ComReg and TERA in Q1 2014, OAOs have expressed concerns about the high level of charges applied to ancillary services. That is why it is recommended to apply to ancillary services the same remedies in the form of cost orientation as to the main access product. Profit margins on ancillary charges would distort competition in favour of Eir as Eir could set excessive prices. It would also restrict alternative operators from migrating to another access service whenever it is more efficient and consequently from climbing the ladder of investment, which is inconsistent with ComReg's objectives as given in Section 3.3.4.

One could argue that the retail-minus approach would be sufficient as it would give – by definition – OAOs sufficient margin to compete with Eir. However, because some of these specific products cannot easily be replicated by OAOs (as they are only available on the basis of the PSTN technology which is a technology that OAOs would never deploy for themselves), a cost orientation obligation is preferable to avoid excessive pricing from Eir on these products (except in very specific case where the product is not sold to a significant extent or where data to calculate cost is not easily available).

5 Recommendations on Geographical De-averaging

Geographic price de-averaging may help to better account for competition conditions in different geographic areas. It may be especially relevant in Ireland, where there are significant differences between urban and rural areas in terms of in terms of population density[46], and consequently electronic communications costs[47] and where there are varying competitive conditions, prospectively[48].

Geographic price de-averaging is or was already explicitly in place in Ireland for some specific products: Ethernet Leased Lines (WSEA physical and logical) and SB-WLR (a €3 monthly promotional discount was previously available in LEA areas).

Access pricing can be tailored to reflect the level of competition in more competitive areas compared to less competitive areas. However, attention should be paid to ensure that regulation is consistent across the national territory and does not negatively impact network deployment plans.

5.1 Economic (theoretical) justification of geographic de-averaging

This section describes the economic theoretical advantages of geographic de-averaging. It is to be noted that section 6.3 reviews advantages but also disadvantages of geographic de-averaging in the specific context of Ireland and of the products at stake.

It is recognised that economically de-averaged prices provide more economic efficiency. The graph below compares economic efficiency under averaged and de-averaged pricing:

- The risk of inefficient duplication arises where access price is significantly higher than replacement cost. In this case, an alternative operator may decide to construct its own network even if it is less efficient than the existing network. When the cost of constructing by alternative operator lies between the efficient replacement cost and the wholesale access price, alternative operators are incentivised to duplicate the network even though it is at a cost that is higher than the efficient replacement cost.
- The risk of insufficient investments arises where the efficient replacement cost is significantly higher than the access price. In this case, an alternative operator decides not duplicate the incumbent's network even if it is capable of doing so efficiently.

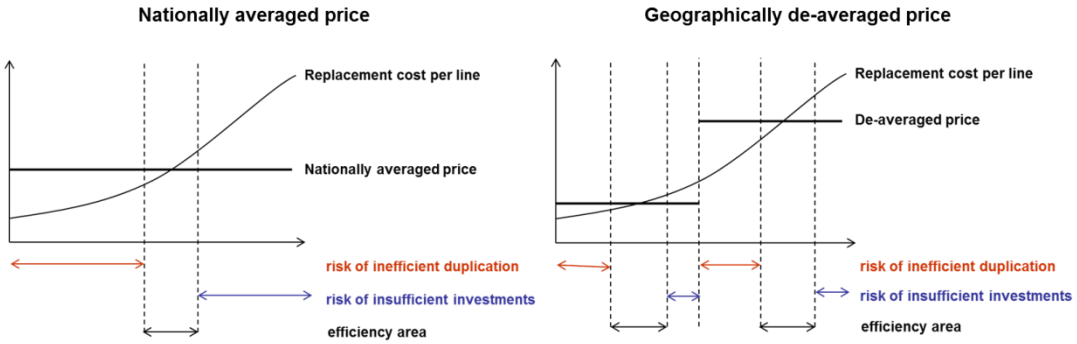
[46] Indeed, the population density in urban areas is much higher than in rural areas: 1,736 persons per km^2 vs 26 persons per km^2 in 2011 (Central Statistics Office, Profile 1: Town and Country, April 2012)

[47] Fixed network costs increase with population density due to longer access lines and a smaller number of users per MDF. This has been analysed in ComReg Decision D01/10

[48] In particular, no alternative infrastructure is present in rural areas, UPC being available mainly in urban areas. (http://www.broadbandspeedtest.ie/faq/). See also ComReg's Decision D04/13 on margin squeeze tests for bundles and the definition of LEA and non LEA areas

- For lines belonging to the efficiency area, the access price is close to the replacement cost. The efficiency area is greater under geographically de-averaged pricing since the access price is closer to the replacement cost curve.

Figure 5. Comparing geographically averaged with geographically de-averaged access pricing



Source: TERA Consultants

Even though geographic de-averaging does not completely solve the problem (access prices remain averaged in given geographic areas and do not fully reflect the economic cost of each consumer line), it improves economic decisions of operators.

Indeed, in its report on Geographically Segmented Regulation for Telecommunications, OECD explains that *"a geographically de-averaged approach to pricing is less likely to distort either competitors' build-buy decisions or the incumbent's own investment plans. A national averaged pricing approach, by contrast, is likely to result in inefficient investment decisions with competitors less efficient than the incumbent entering high value customer areas e.g. Central Business District (CBD) and certain metropolitan areas. This could lead to an inefficient duplication of the local loop in such areas. On the other hand, on the basis of averaged pricing, competitors may make more use of the incumbent's infrastructure in non-urban areas than is efficient, making smaller investments in their own alternative infrastructure than is cost-effective."* [49]

In the United Kingdom, Ofcom shares this opinion: it recognises that de-averaged prices could provide better signals for investment decision-making but chooses to use geographically averaged prices for LLU because of *"consumer affordability issues and significant practicality issues"*:

> *"While de-averaged charges can more precisely reflect the costs incurred in providing LLU services in each area and can provide better signals for investment decision making, there are consumer affordability and significant practicality issues associated with de-averaging charges."*[50]

[49] OECD. Working Party on Communication Infrastructures and Services Policy. Geographically Segmented Regulation for Telecommunications. DSTI/ICCP/CISP(2009)6/FINAL 22 June 2010

[50] Ofcom. Local loop unbundling: setting the fully unbundled rental charge ceiling and minor amendment to SMP conditions FA6 and FB6. Statement. 30 November 2005 http://stakeholders.ofcom.org.uk/consultations/llu/

Other countries such as Australia have gone one step further in their analysis by implementing geographically de-averaged access pricing.[51]

5.2 Defining relevant geographic areas

If it is decided to introduce the geographic de-averaging of access prices in Ireland, the relevant breakdown of the national territory should be defined. It is necessary to distinguish between areas where investment in network infrastructure from private operators is likely and areas where it is unlikely. These areas may be defined more or less broadly:

- Definition #1. ComReg's Decision D04/13 on bundles regulation[52] splits margin squeeze methodologies between the LEA and other areas which have different competition dynamics. According to this decision, an exchange area may be qualified as LEA based on several criteria: presence of an AIP (Alternative Infrastructure Provider), presence of an OAO (Other Authorised Operator) not being an AIP, presence of Eir's NGA offer and proximity to qualifying exchanges (cf. section 3.2.3).
- Definition #2. It is possible to give a larger definition of potential areas where investment in network infrastructure from private operators is likely than the LEA (called also "urban" areas in Table 9). These areas may include those exchanges where the competition has not developed yet but where Vodafone/ESB are planning to build their NGA network. In this case, identifying these areas is similar to the identification of white areas in the context of broadband network state aid. Indeed, EU Guidelines for the Application of State Aid Rules in Relation to the Rapid Deployment of Broadband Networks (2013/C 25/01) indicate that Member State should identify such areas through a public consultation process. The identification of these areas will therefore need to be conducted in the context of the Irish National Broadband Plan.
- Definition #3. In the previous LLU Decision D01/10, ComReg has distinguished between exchanges that are likely to be unbundled (which is a smaller area than LEA areas) and exchanges that are unlikely to be unbundled. The average per-line cost has been calculated mainly on the basis of the costs in the first type of exchanges. This way, alternative operators do not have to pay on the basis of the costs in those exchanges that are unlikely to be unbundled. This breakdown can be reused, with the first area grouping together exchanges that are likely to be unbundled and the second area grouping together areas that are unlikely to be unbundled.

[51] ACCC. Fixed Services Review: A second position paper. Public version, April 2007

[52] See Section 3.2.2.

For the time being, the first definition is the most relevant since the LEA has already been defined by ComReg and it provides more regulatory consistency than introducing a new definition.

Also, it appears that LEA areas are consistent with exchanges targeted by OAOs buying LLU/VUA and therefore definition #3 should derive similar outcomes to definition #1. For the time being, it is difficult to determine whether definition #2 is a relevant option since Vodafone/ESB plans are in initiation phase, despite the 2nd of July 2014 announcement[53]. Indeed, this new network deployment may overlap with Eir's NGA plan and therefore be included in the LEA areas (see section 3.2.3).

However, it should not be excluded that the relevant geographic split between areas where investment in wired access network infrastructure by private operators[54] is likely and other areas could evolve in the future depending on the infrastructure deployment strategies of other alternative operators as well as the roadmap set out in the National Broadband Plan.

In theory, definition #2 should be preferred because this is the one that fully considers investment from private operators (without public subsidies) in wired access network infrastructure. **Therefore, in the medium term, this definition should be retained, once plans are fully known.** This is also the area that is likely to be the most stable over time.

In the rest of the document, areas where investment in wired access network infrastructure by private operators is likely will be named "LEA" as it provides more regulatory consistency. However, it would be worth locking the LEA on the basis of today's definition for two reasons: first because it would provide more regulatory stability and second because if Eir deploys NGA outside the current definition of LEA, it is likely to be deployed at exchange and not at cabinets and therefore, only the cheaper lines of these additional exchanges (the ones close to the exchange) will be included and therefore an update of the LEA will not change the results.

With respect to SLU, the geographic area used to set SLU prices could be further adjusted for the following reasons:

- SLU is used to provide NGA services. This is because NGA services provided on the basis of the DSL technology improve significantly the speed of the customer line as long as the customer line from the cabinet is short (typically less than 1.5 km). Purchasing SLU enables to shorten the length of the customer line. The price of SLU should be based on the cost of the line shorter than 1.5 km from the cabinet.
- It is not clear whether SLU will be bought inside LEA or outside LEA:

[53] https://www.esb.ie/main/press/pressreleaseWS.jsp?id=4074

[54] Wireless costs are very different and therefore the price of the copper access network should not be used as a tool to incentivise wireless deployments.

  - Inside LEA, Eir is implicitly using SLU (which is an input to the VUA price) but OAOs are not using SLU,
  - Outside LEA, SLU may be used by the selected operator for the National Broadband Plan if FTTC is considered as a relevant technology but will not be used if FTTC is not considered as a relevant technology to fulfil the NBP objectives.

- However, the distinction between inside LEA and outside LEA is less relevant for SLU because the cost of the sub loop for sub loops shorter than 1.5 km is very homogeneous all over the country. As a consequence, a nationally averaged cost or a cost calculated for the LEA areas only would provide similar results.

In the rest of the document, the different choices in relation to geographic de-averaging are therefore not directly relevant to SLU because it is proposed the SLU price on the basis of the costs of the sub loop shorter than 1.5 km from Eir's cabinets.

5.3 Conclusion on the prospects of geographic de-averaging in the Irish context

Geographic de-averaging of access prices leads to more efficient investment decisions by operators. However, this can significantly increase the digital divide. This means the decision of geographic de-averaging access prices is mainly **a policy decision and this report can only provide an economic view on this issue.** Such a decision can probably only be made once the level of geographic price differentiation which is relevant is known, i.e. once cost models have been developed and validated.

Geographic de-averaging of access prices may be relevant in the specific case of Ireland since the level of competition between operators is very different in rural areas compared to urban areas. In addition, geographic de-averaging has already been introduced *de facto* by Eir which proposes SB-WLR price discounts in some areas and not in others. If geographic de-averaging of access prices is selected, then it is recommended to use the same geographical areas as in ComReg's Decision D04/13: LEA and non LEA.

6 Recommendation on the most relevant costing approach

Where a cost orientation pricing approach is chosen, NRAs need to build a model capable of calculating the corresponding cost. Results can vary significantly depending on the cost modelling approach chosen. The current section treats the main modelling principles and identifies recommendations in the Irish context. Section 6.1 defines the main approaches to cost modeling. Section 6.2 gives costs / price ranges under the different approaches. Section 6.3 concludes on the approach that might be most relevant in the Irish context.

6.1 Elements of the Costing Approach

This section defines the main costing approaches, describes their advantages and disadvantages and explains in which circumstances they are the most relevant. Section 6.1.1 covers bottom-up and top-down modelling approaches, Section 6.1.2 compares LRIC and FAC cost standards, while Section 6.1.3 compares the most relevant depreciation methods and Section 6.1.4 discusses the size of the modelled operator.

6.1.1 Modelling Approach: Bottom-up or Top-down

A cost model may be based either on bottom-up approach on a top-down approach.

Under a top-down approach, cost inputs are taken from the operator's accounting data, on the basis of the cost items that are relevant for the services in question. Generally, the accounting net book value of each asset is taken as the basis for capital costs and this value is depreciated over the remaining lifetime of each asset. Operating expenditure is also estimated from historical accounting information and common cost items are allocated to different services using allocation keys (see 6.1.2 for discussion).

Under a bottom-up approach, a detailed model is constructed that rebuilds a hypothetical efficient network today. The evaluation is based on current asset prices. Bottom-up models use demand data as a starting point and determine an efficient network capable of serving that demand. The network is modelled using economic and engineering principles to deliver the required electronic communications services and to satisfy the demand for these services.

On a high-level, a bottom-up model is developed within three broad steps:

1 First, services to be modelled are identified (different access services, ancillary services) and data on the service demand are gathered (number and location of customers).

2 Second, the model designs the network by establishing which assets (equipment, cables, etc.) are required to provide the services and their related demand.

3 Once the network has been designed, each asset is valued and depreciated, and operating and maintenance costs are added. A unit cost of usage can be derived (for example, cost per line and month or cost per connection or per migration

from one service to another) through allocation keys (for example, number of lines). See 6.1.2 for discussion.

The main advantages and drawbacks of each approach are given in the table below.

Table 11. The main pros and cons of top-down and bottom-up models

Approach	Advantages	Disadvantages
Top-down	• A top-down model provides incentives to invest to the regulated operator since through the access price the operator is compensated for all the investments made. • A top-down model may be less time-consuming and less costly to implement.	• In a top-down model, the scope for efficiency adjustments is limited, so that often existing cost inefficiencies are embedded in the model. • Top-down models cannot easily provide forward-looking cost estimates. • A top-down model lacks transparency due to confidentiality issues regarding the modelled operator's data. • Top-down models rely on data that may be out-of-date. From the time an operator gathers enough data to build its own top-down model to the time it completes the model, asset prices and technologies may have changed to a large extent. • Depending on regulatory accounts provided by the regulated entity, it may be difficult to derive regional or local results as sometimes the model can only provide results at a national level. However, such granularity is available in Eir's cost accounting systems for the local loop.

Approach	Advantages	Disadvantages
Bottom-up	• The model sends correct build-or-buy signals, and so is especially relevant where there is infrastructure based competition or where infrastructure needs to be renewed (see Arcor case). • It is easier to deal with (in)efficiencies. • A bottom-up approach provides a better understanding of underlying cost structures and is able to determine more accurately the changes in cost over time. • This approach can be fully transparent by making publicly available all the inputs, engineering rules and assumption used. • A bottom-up model is also able to anticipate costs of a network that is currently being built (such as for example an FTTH network). • It is quite flexible on a number of parameters. • A bottom-up model can provide regional or local results with more ease and reliability compared to a top-down model.	• Since bottom-up models aim to calculate the costs incurred by a hypothetical efficient operator, they may over-optimise or omit costs. • It can be difficult to achieve the hypothetical efficiency level constructed in bottom-up models. • It is difficult to model operating expenditures since this requires a deep understanding and experience of network operations. • The modelling process can be time-consuming and expensive.

Source: TERA Consultants

The main economic reason to use a bottom-up model is the need to send a build-or-buy signal to alternative operators who may want to replicate the asset. It is also more efficient to make forward-looking estimations.

The top-down approach is better suited to achieve exact cost-recovery.

6.1.2 Cost standard

Cost standard defines the method of distributing costs between services.

The prices should be set in such a way that the total cost of the local loop is distributed between different wholesale services across all the lines of an exchange. This way, Eir recovers exactly its costs (in the case of the top-down model) or a hypothetical operator recovers exactly its costs (in the case of the bottom-up model). If an asset is dedicated to a particular service, there is no need for an allocation rule. However, certain assets are used by several services:

- "Joint costs" are costs that are incurred by a set of services but not by all services (e.g. DSLAM can be used to provide voice and Internet services but not high speed leased lines);
- Network common costs are network costs used by all services (e.g. trenches in fixed networks);
- "Corporate overheads" (also known as "un-attributable costs" or "non-network common costs") are costs that cannot be attributed in a non-arbitrary way (e.g. costs associated with the Chief Executive or the costs of operating a car fleet).

The two main cost standard methodologies are **Fully Allocated Cost**[55] and **Long Run Incremental Cost**.

- **Fully Allocated Cost (FAC)** is an accounting approach based on the expenses incurred by the regulated operator; a share of common costs is allocated to each service according to cost causation principle and using allocation keys.
- The **Long Run Incremental Cost (LRIC)** methodology is an economic approach which considers that the cost of a service is equal to the change in the total long run (that is when all inputs are variable) cost resulting from a discrete variation in output due to that service.

As the ERG states it[56], the "*FAC approach attributes all relevant costs, revenues, assets and liabilities incurred by an undertaking to all of its outputs applying the causality principle. Attribution methodologies need to be developed and applied where costs are not directly allocable to the reporting object (e.g. component, market or regulated service).*" In other words, the FAC of a service is the cost incurred in providing that service, on the basis that none of the operator's costs are left unallocated. This implies that part of the common costs is allocated to the service involved, and the allocation can be done in various ways, but is typically done with some (proportional) relationship to the (direct) costs that are already allocated.

LRIC is often used in electronic communications markets. It can be defined as the long-run cost of serving a defined "increment" of service. The ERG 2005 Guidelines for implementing the Commission Recommendation on Accounting Separation & Cost Accounting Systems stated that:

[55] Also called Fully Distributed Cost (FDC).

[56] ERG, Guidelines for implementing the Commission Recommendation C (2005) 3480 on Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications

> *"Conceptually, the LRIC (Long Run Incremental Cost) methodology calculates the cost of providing a defined increment of output, on the basis of forward looking costs incurred by an efficient operator.*
>
> *When applying a long run perspective, all costs (including capital investments) are assumed to be variable (or avoidable). LRIC therefore provides NRAs with a methodology by which the costs of the capital-intensive electronic communications market, which, at the wholesale market level, is characterized by significant investment costs and long term asset lives, can be analysed and used for cost-orientation and pricing purposes*[57]*."*

LRIC is therefore calculated as the difference between

- the total long-run cost of a network providing all services; and
- the long-run cost of a network providing the same services minus an "increment" of services.

The resulting cost estimate will therefore depend on the size of the service increment. In our case, access to the local loop is the main service at stake and therefore NRAs always consider the increment to be the whole local loop.

The European Commission explains that FAC and LRIC are similar under the condition that the increment includes all the services:

> *"Depending on the size of the increment, only costs associated with the services included in the increment would be allocated to that increment. If, for example, there was only one increment including all services provided by an operator, then LRIC would cover all costs and, in fact, be equivalent to Fully Allocated Cost (FAC). If smaller increments are chosen (such as a particular service), a LRIC model facilitates the recovery of costs proportionate to the size of the increment in question and requires a decision on an appropriate cost-allocation mechanism for joint costs (costs that can be directly attributed to more than one specific service) and common costs (costs which are not directly attributable to specific services) with regulators often applying a mark-up to account for these costs."* [58]

It means that LRIC would be similar to FAC approach. However, the difference is in the efficiency level. The concept of LRIC cost is always applied to a hypothetical efficient operator, while the FAC concept is applied to an existing operator. Indeed, it is reflected in the definition by ERG:

[57] ERG Common Position: Guidelines for implementing the Commission recommendation C(2005)3480 on Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications, 2005.

[58] Commission staff working document accompanying the commission recommendation on the regulatory treatment of fixed and mobile termination rates in the EU, explanatory note, 7.5.2009, SEC(2009) 600

> *"Conceptually, the LRIC (Long Run Incremental Cost) methodology calculates the cost of providing a defined increment of output, on the basis of forward looking costs incurred by an efficient operator".*[59] (underlined by TERA)

The characteristics of bottom-up models inherently call for the LRIC methodology. Bottom-up models aim at calculating economic costs and are therefore using the LRIC cost methodology. The combination between the LRIC methodology and bottom-up models is one of the most commonly encountered practices in cost models. As a bottom-up approach is mostly an engineering and economic approach, it calls for an economic approach for calculating costs. LRIC can also be more difficult to implement with top-down models because of the presence of potential inefficiencies in the top-down costs[60]. LRIC is sometimes implemented in top-down systems and efficiency adjustments are also sometimes performed but top-down models are not well adapted to do so compared to bottom-up model.

The following cost standard is recommended for each of two modelling approaches:

- FAC approach for the top-down model,
- LRIC approach for the bottom-up model ("BU-LRIC").

6.1.3 Depreciation method

The electronic communications industry is a capital-intensive industry which can require significant investments. An operator investing in a given network asset bears an upfront cost and expects that this asset will generate revenues over its useful life. Throughout its useful life, the value of this asset will naturally decrease as it ages. This loss of asset value throughout its useful life is reflected in operator's profit and loss accounts as depreciation charges. In regulation, the cost of capital is also added to the depreciation charge to set regulated prices. Indeed, when making an investment, an operator will support financial costs related to the interests requested by its shareholders or the banks that are lending money to the operator. This financial cost must be considered to make sure that the operator is fully recovering its costs. The sum of the two items (depreciation charge and cost of capital of the year) is called the annuity. Annuities related to an investment must verify the following equation to make sure that costs are exactly recovered:

[59] The ERG 2005 Guidelines for implementing the Commission Recommendation on Accounting Separation & Cost Accounting Systems.

[60] In theory LRIC and efficiency are different concepts but in practice they are used simultaneously (see for example, ERG statement: *"Conceptually, the LRIC (Long Run Incremental Cost) methodology calculates the cost of providing a defined increment of output, on the basis of forward looking costs incurred by an efficient operator."*

$$I = \sum_{i=1}^{n} \frac{A_i}{(1+w)^i}$$

Where *I* is the investment, *n* is the asset life, *w* is the cost of capital and A_i is the annuity for the year *i*. This means that the discounted sum of annuities recovers exactly the investment.

There is an infinite number of solutions to this equation, i.e. an infinite number of ways to depreciate an investment over its lifetime[61].

Depreciation methods generally used are the following:

- straight line or linear depreciation (also called HCA, Historic Cost Accounting),
- CCA-OCM (Current Cost Accounting - Operational Capital Maintenance),
- CCA-FCM (Current Cost Accounting - Financial Capital Maintenance),
- standard annuities,
- tilted annuities, and
- economic depreciation.

A detailed description of these methods is provided in Annex. In summary:

- straight line/HCA depreciation is widespread in statutory accounts but is not well suited to regulation as it does not sufficiently take into account changes in asset prices and does not provide price stability when regulated prices are based on this method (see section 11.2.1). However, it facilitates comparison with accounts and can therefore be useful to reflect yearly changes in the level of investment of operators,
- CCA-OCM is never used in regulation as it does not ensure cost recovery (see section 11.2.2),
- CCA-FCM takes into account changes in asset prices (see section 11.2.3). Many SMP operators in Europe show their accounts under the CCA-FCM approach. Even if it is a significant improvement over straight line/HCA depreciation, this is not sufficient to properly take into account price changes,
- Standard annuities give a flat annuity (annuity = depreciation + cost of capital) which is a valid approach when asset prices and service demands are stable (see section 11.2.4),
- The tilted annuity approach is the most widespread approach used in electronic communications regulation (see section 11.2.5). It calculates annuities which evolve with asset price trends which means that regulated prices derived from

[61] Depreciation can be seen as the allocation of costs over time.

this method are evolving smoothly. This is relatively easy to calculate even if it requires assessing price trends which can be a difficult exercise.

- Economic depreciation is the most robust method from a theoretical point of view but is also the most complex to implement because it requires several assumptions (see section 11.2.6). When asset prices are changing fast and/or when the number of customers/level of demand is changing fast and/or operating costs are changing fast, the economic depreciation calculates regulated prices that remain stable over the economic lifetime of assets (tilted annuities only have this feature when asset prices are changing fast).

A comparative table of different methods is presented below.

Table 12. Comparing depreciation methodologies

Methodology	Cost recovery	Inclusion of price trend	Evolution of consumer demand	Simplicity of calculation
Linear depreciation/HCA	✓	×	×	Easy
CCA-OCM	×	✓	×	Normal
CCA-FCM	✓	✓	×	Normal
Standard annuity	✓	×	×	Normal
Tilted annuity	✓	✓	×	Normal
Economic depreciation	✓	✓	✓	Complex

Source: TERA Consultants

When a bottom-up model is developed, all methods can be implemented but the most appropriate methods from an economic point of view are the tilted annuity and the economic depreciation approaches. If the number of customers using the assets at stake is not changing fast, then applying a tilted annuity to reflect asset price changes will be relevant.

In the case that the top-down approach is the preferred approach, different depreciation methods can be used, especially HCA, CCA and Tilted annuity[62]. However, attention should be paid to avoid under- or over-recovery of cost when using the Tilted annuity approach. The problem of under- or over-recovery arises if such an approach does not take into account the level of costs that have already been depreciated by the operator. However, if this approach is applied to the Net Book Value of assets and over their remaining asset lifetime (which requires detailed information on the history of asset deployment) then it can be selected. In this case, the Tilted annuity approach ensures exact cost recovery, like the CCA-FCM and HCA methods. Nonetheless, applying such

[62] A standard annuity approach could also be relevant but this is similar to a tilted annuity with no price trend. This is therefore considered as inferior.

an approach to partially depreciated assets will not provide the same economic outcomes (price stability) that would result if they are applied to newly bought assets (which is the core assumption in bottom-up models).

6.1.4 Market Share of the hypothetical operator

In order to set appropriate wholesale access prices, it is critical to consider the right level of economies of scale. In particular, the unit cost of one line is calculated by dividing the total cost by the number of active lines. As some costs are not sensitive to the number of lines the unit cost of one active line decreases as the number of lines in an exchange increases.

In a top-down model, because the costs are the costs of the SMP operators, the most relevant number of customers to be considered is the one of the SMP operator.

However, a bottom-up model is designed to simulate the network of a hypothetical efficient operator. Therefore it is necessary to make an assumption on the potential number of customers served by this operator in order to dimension the network. Two options are generally used: the equally efficient operator (EEO) option and the similarly efficient operator (SEO) option. An EEO has the same cost function as the SMP operator and the same number of customers, so that it benefits from the same economies of scale. An SEO has the same cost function as the SMP operator but the cost base is distributed among a smaller number of customers, so that the economies of scale are less significant.

Using a market share equal to the incumbent's market share will lead to lower wholesale prices compared with using the lower market share of the SEO. However, the higher access prices due to using a lower market share can provide better economic signals for alternative operators, but may favour inefficient entry and may generate excessive retail prices.

6.2 Cost estimations

The choice of an appropriate costing/pricing methodology must not be too theoretical: as a consequence, TERA Consultants complements its theoretical analyses by providing indicative price rate ranges of each costing methodology.

The results for the full top-down approach, the hybrid top-down and bottom-up approach as well as the full bottom-up approach are available.

NB: the figures below are provided to compare the different methodologies together. They cannot be directly compared with the results provided in ComReg access pricing document because the results below do not factor effects such as line losses, reduction in line length for LLU, etc.

Table 13. LLU prices under proposed approach, €/line/month (including wholesale specific cost), 2017[63]

Total €/line/month including fault repair	Top-Down HCA FAC[64]	BU-LRIC with trenches and poles on TD HCA FAC[65]	BU-LRIC with trenches and poles on TD CCA FAC	BU-LRIC with trenches and poles on TD Tilted annuities FAC	BU-LRIC
Inside LEA	€13.4	€12.1	€12.1	€11.6	€23.0
Outside LEA	€16.6	€28.7	€28.3	€27.9	€49.2
National	€14.4	€17.4	€17.3	€16.8	€31.3

Source: TERA Consultants

These prices can be compared with the previous price of €12.41 per line per month[66] or with the existing price of €9.91 per line per month (+€0.96 in both cases for fault repair) and show that:

- Approaches mixing BU-LRIC and top-down inside LEA give results that are close to existing prices;
- A pure BU-LRIC approach is extremely high at the national level but is also very high inside LEA only;
- The difference between Inside LEA and Outside LEA is greater in BU-LRIC compared to Top-Down HCA FAC:
  - €3.2 in Top-Down HCA FAC versus €26.2 in BU-LRIC;
  - +24% versus +230%.
- However, the Top-Down HCA FAC is very high Outside LEA, around €5 more than the cost inside LEA based on an hybrid approach.

6.3 Conclusion on the Best Approach for Each of Services Under Review

As explained in 3.3, ComReg's goals in the context of access pricing are summarised in the table below:

[63] The following assumptions have been used Year : 2017, rate of reutilisation of civil engineering assets : between 92 and 95%, WACC : 8.18%, Fault clearance included; no line loss compared to today, no line restriction.

[64] The values may be slightly higher than Eircom's accounts because a lower number of lines is assumed in 2017 compared to today.

[65] It is assumed that some trenches and poles need to be reconstructed.

[66] ComReg Document 10/10 (Decision D01/10).

Table 14. Criteria of choosing access pricing and costing methodology

Market	Areas with relatively high cost of network deployment	Areas with relatively low cost of network deployment
WPNIA	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Maintaining price stability	• Sending a correct build-or-buy signal having in mind duplication of the local loop is not necessarily desirable • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability
WBA / SB-WLR	• Avoiding over-recovery of costs by Eir • Avoiding under-recovery of costs by Eir • Ensuring consistency across investment ladder • Maintaining price stability	• Ensuring consistency across investment ladder • Sending a correct build-or-buy signal having in mind that use of WPNIA products by OAOs is desirable • Avoiding over-recovery of costs by Eir (not a priority if not compatible with other objectives)

Source: TERA Consultants

These criteria will thus be used for each recommendation:

- Recommendation on Differentiated Treatment of Different Assets (see section 6.3.1)
- Recommendation on modelling approaches (see section 6.3.2);
- Recommendation on cost standards (see section 6.3.3);
- Recommendation on depreciation methods (see section 6.3.4).

A combined recommendation is provided in section 6.3.5.

6.3.1 Recommendations on Differentiated Treatment of Different Assets

The 5 wholesale services at stake share some common assets and common costs, as shown in the table below which summarizes the scope of costs covered by each service:

Table 15. Assets and costs shared by wholesale access services

	Full LLU	SLU	Line Share	SB-WLR	Naked DSL
Network Termination Unit (NTU)	✓	✓	✓	✓	✓
Final drop	✓	✓	✓	✓	✓
Trenches/chambers/poles on D-Side	✓	✓	✓	✓	✓
D-Side cables and joints	✓	✓	✓	✓	✓
Cabinet	✓	✓	✓	✓	✓
Trenches/chambers/poles on E-Side	✓		✓	✓	✓
E-Side copper cables and joints	✓		✓	✓	✓
E-Side fibre cables and joints					
Main Distribution Frame (MDF)	✓		✓	✓	✓
Voice line card				✓	
DSL line card					✓
Traffic related costs (backhaul, aggregation nodes, etc.)					✓
Wholesale specific costs	✓	✓	✓	✓	✓

Source: TERA Consultants

Two different broad approaches can be used for the setting of wholesale access prices of services using same assets:

1. Defining a costing methodology for each service independently and then deciding on the appropriate costing methodology of each service by considering the services that ComReg wants to promote, e.g. if D-Side cables are based on the BU-LRIC approach for SB-WLR, they could be based on a Top-Down HCA-FAC approach for SLU or full LLU;
2. Defining a costing methodology for each asset and keeping, for a given asset, the same costing methodology for each service which uses this asset, e.g. if D-Side cables are based on the BU-LRIC approach for SB-WLR, they would be based on the BU-LRIC approach for full LLU, Line Share, SLU, Naked DSL.

The second approach may bring the most benefits to the industry. It may ensure consistency across the value chain and may send a correct build-or-buy signal. Under this approach, operators automatically choose the service and the corresponding investment level that is most relevant for each given exchange and at each moment in time. This approach is also consistent with the analysis in section 4.3.2 as this approach also provides more consistency across the investment ladder. Potential discrepancies in the way a given asset is treated could favour, for example, the use of Naked DSL against

LLU or SLU, and so would prevent an alternative operator from climbing the investment ladder. Under the first approach, the costing methodologies selected by ComReg would influence operators' choice and ComReg's role would be too intrusive in operators' strategies.

6.3.2 Recommendations on modelling approaches and potential price de-averaging

In accordance with the criteria table (see section 6.3) and in accordance with the choice:

- to select relevant costing methodologies for each asset; and
- to keep, for each asset the same costing methodology for each service which uses this asset.

costing methodologies are identified inside and outside LEA[67] and for the different group of assets at stake:

1 reusable passive civil engineering assets (trenches/chambers/poles on the D-Side and on the E-Side),

2 other local loop passive assets (NTU, final drops, D-Side cables, E-Side cables, cabinets, MDF)[68]

3 and active assets (voice and DSL line card, traffic related costs).

As detailed in section 3.3, other passive assets (i.e. copper cables) can be treated differently depending on the local context: in the LEA these assets can be renewed or duplicated, but this is unlikely in the non LEA areas. As a consequence three options are considered for determining the price for the wholesale access services (i.e., LLU, SLU, SB-WLR and Naked DSL):

0 Option 0 "nationally average price" based on the whole country (LEA and non LEA) costs;

1 Option 1 "nationally de-averaged price" between LEA and non LEA;

2 Option 2 "nationally averaged price" based on LEA costs

Option 0 "nationally averaged price" based on the whole country (LEA and non LEA) costs

The simplest and easiest way to establish the cost of each asset (reusable passive civil engineering assets and other passive assets) is to set the same price across the whole

[67] In this section areas where investment in wired access network infrastructure is likely are assumed to be LEA areas (see section 5.2)

[68] This would also include civil engineering assets which cannot be reused for NGA

national territory based on the average cost of a line in the whole country (LEA and non LEA included).

This approach meets the requirements of the 2013 European Commission Recommendation on costing methodologies[69]: **the EC does not provide guidance on whether the cost should be calculated only in areas where LLU occurs or for the whole territory.** In this respect, this option is consistent with the EC Recommendation.

The main drawback of this option is that it is likely to raise the wholesale copper access prices in the LEA to a non-competitive level (see section 6.2) and above the range of price recommended by the European Commission. This is because Ireland has a specific demographic and geographic situation which implies that local loop national average costs are very expensive compared to other countries (as demonstrated in ComReg Decision D01/10). Moreover if this option is combined with a bottom-up valuation approach for some assets (especially the other passive assets), the national price level would be significantly higher than the fully top-down cost incurred by Eir. This would preclude the achievement of the “competition” and “investment” objective for ComReg and could lead to the foreclosure of the wholesale market. It would also probably lead to price increases at the retail level because, as explained in section 4.1, margin squeeze are not generally allowed and therefore, to avoid a margin squeeze, an increase in a wholesale price could lead to an increase in a retail price.

Given the reasons above, “Option 0” is not considered further in this report.

As a consequence, only “Option 1” (nationally de-averaged price) and “Option 2” (nationally averaged price with cost based on LEA) is considered to assess the impact on:

- Civil engineering assets which can be reused for NGA;
- Other local loop passive assets including civil engineering assets which cannot be re-used for NGA and must be replaced;
- Active assets.

These 2 options would provide lower wholesale access prices more compatible with existing regulated prices and with the price band recommended by the European Commission (€8-€10).

[69] European Commission, Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment.

6.3.2.1 Civil engineering assets which can be reused for NGA[70]

In its September 2013 recommendation, the European Commission distinguishes between reusable and non-reusable civil engineering assets.[71] Reusable assets should be valued based on RAB (Regulatory Asset Base), which is a top-down approach (see section 8.4 for more details). According to preliminary interviews with Eir, it appears that ducts and poles can be reused to a large extent in Ireland for NGA, at least for FTTC. For these civil engineering assets, which have a relatively long lifetime and which cost a lot, their duplication is not desirable and should be avoided. That is why no infrastructure-based competition is expected to develop for these assets, and a top-down approach would be the most appropriate for them, to be applied as an input to all the cost oriented services: LLU, SLU, Line Share, SB-WLR and Naked DSL. Indeed, such an approach facilitates strict cost recovery.

An application of the promotion of sustainable competition in case of enduring bottlenecks can be found in the 2010 European Commission Recommendation on regulated access to Next Generation Access (NGA) networks. The Recommendation recognises that the fixed civil engineering cannot be bypassed for FTTH services, but that a parallel fibre network would be beneficial for competition as it consists in infrastructure-based competition. Access to civil engineering should thus be mandated so that alternative operators could deploy fibre networks that compete with the SMP operator.

It can thus be concluded that in the context of civil engineering for fixed local loop, no infrastructure-based competition can be expected on the civil engineering access service (the infrastructure will remain an enduring bottleneck), whereas infrastructure-based competition can arise with competing fibre local loops (i.e. parallel fibre networks in a single civil engineering asset). This is why the NGA Recommendation states that civil engineering prices should reflect the cost effectively incurred by the operators, which means adopting a top-down cost approach:

> "*Access to existing civil engineering infrastructure of the SMP operator (...) should be mandated at cost-oriented prices. NRAs should ensure that access prices reflect the costs effectively borne by the SMP operator*[72]*.*"

When the Advocate General of the European Court of Justice in the Arcor Case states *"where incentives to invest in alternative infrastructure justifiably take precedence over the aim of fostering short-term competition on the local loop access market, giving priority to the cost of investment in a new, modern and efficient network at the expense of the*

[70] "*'Civil engineering infrastructure' means physical local loop facilities deployed by an electronic communications operator to host local loop cables such as copper wires, optical fibre and co-axial cables. It typically refers, but is not limited to, subterranean or above-ground assets such as sub-ducts, ducts, manholes and poles*." (Recommendation on NGA, Article 11)

[71] See annex, section 11.1.2.

[72] European Commission Recommendation 2010/572/EU on regulated access to NGA, Annex 1.2.

notified operator's actual capital costs should be regarded as compatible with the principle of rates set on the basis of cost-orientation"[73]*,* this is clearly less the case (that incentives to invest in alternative civil engineering assets infrastructure take precedence over the aim of fostering short-term competition) for civil engineering assets.

It is believed that Eir's ducts and poles can be significantly reused for NGA. Only a detailed review of Eir's ducts and poles would enable the verification of this assessment. However, when underground cables are installed in ducts (underground cables can also be installed directly underground, without ducts, but this is rarely the case in Ireland to our knowledge), fibre cables can also be installed, especially as they take much less space and as spare ducts are generally available. The same approach should apply for poles. However, even if Eir's poles cannot be reused, electricity poles, which may be more robust, may be reused (this is envisaged by Vodafone/ESB, see section 3.1.2), especially with the new EU regulation to lower the costs for deploying broadband[74] which is expected to enter into force in the Member States from 1 July 2016. This means in all cases, existing civil engineering assets can probably be reused to a significant extent. As a consequence, using a bottom-up approach is not valid as explained in section 6.1.1. A top-down approach is more relevant, or when electricity poles can be re-used, wholesale pole access prices can be relevant.

It should be further decided whether the cost is calculated on the national level or is geographically de-averaged. As a consequence, two options can be identified (Option 0 being disregarded).

Option 1: nationally de-averaged price

Under Option 1, access prices are geographically de-averaged.

Since civil engineering which can be reused for NGA is not going to be replaced in either the LEA or in the non-LEA, the main regulatory principles for this asset should be to guarantee Eir cost recovery and to incentivise other operators to access this non-replicable infrastructure at a cost-oriented price. The price that ensures Eir's cost recovery is based on a top-down approach, reflecting Eir's incurred costs. The price is calculated separately for the LEA and non-LEA areas under this option.

Option 2: nationally averaged price

Option 2 minimizes the risk of digital divide by setting the same price across the whole national territory.

[73] "Actual" cost does not mean here "current cost" but "real" costs of the operator at stake. Indeed, the Advocate General states*: "This model is, therefore, based on the costs which an efficient operator would have incurred in order to acquire the network and put it into operation. (41) A model of this kind differs from a 'top down' model, which is based on the notified operator's actual costs."*

[74] http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/trans/141234.pdf

Since civil engineering is not going to be replaced in either the LEA or in the non-LEA, the main regulatory principle for this asset should be to guarantee Eir cost recovery and to incentivise other operators to access to this non-replicable infrastructure at a cost-oriented price. The price that ensures Eir's cost recovery is based on a top-down approach, reflecting Eir's accounts. Since alternative infrastructure deployment in non-LEA is unlikely, the top-down cost is based on a line located in the LEA (and applied nationally).

6.3.2.2 Other local loop passive assets including civil engineering assets which cannot be re-used for NGA and must be replaced

In line with the previous section, two options are proposed to calculate costs of assets other than civil engineering assets. They are detailed below.

Option1: nationally de-averaged price

Under Option 1, access prices are geographically de-averaged.

A bottom-up approach would be the most appropriate for the copper infrastructure in the LEA, where competition is developing and where copper is likely to be replaced by private initiatives. It is consistent with the European Commission's recommendation (see section 11.1.1) and the Advocate General of the European Court of Justice Opinion in the Arcor Case (see section 11.1.2).

The FTTC network is currently developing in the LEA, so that copper cables on the E-side, between an exchange and a street cabinet, are going to be replaced by fibre cables. A correct build-or-buy signal needs to be sent to incentivise the investment on the E-side. Cables on the D-side are going to be replaced only if the FTTH technology is deployed (see Eir and Vodafone/ESB announcements described in section 3.1.2). Even though this technology will be used to a lesser extent in the short term, it may develop in the long term, which is why it is necessary to prepare consistent regulation in advance and to choose the bottom-up approach that sends a correct build-or-buy signal. Otherwise, it would be difficult to ensure regulatory consistency by changing the regulation after FTTH begins to develop in the future, as wholesale access prices will already have been set too low. Also, higher LLU prices will provide greater incentives for OAOs to invest in NGA today. Additionally, a top-down approach would not send correct "build or buy" signals and may weaken coaxial cable-based competition, preventing UPC from competing and recovering its costs while also inhibiting Vodafone/ESB from investing (see section 3.1.2.3).

In the LEA, the bottom-up approach therefore respects the criteria of sending a correct build-or-buy signal and ensuring consistency across the investment ladder.

Outside the LEA, a top-down approach is relevant for non-civil engineering assets. In fact, FTTC or FTTH are unlikely to develop in these areas under private investments. Hence, there is no need to send a build-or-buy signal. Moreover, a top-down approach

avoids over- and under-recovery. Finally, a top-down approach ensures a strict cost-recovery by being fully in line with Eir's accounts.

Based on the cost estimations[75] the suggested measure would lead to a price differences between LEA and non LEA areas of around €5 (excluding VAT)[76]. The de-averaging of prices thus leads to higher prices (even under a top-down approach) outside the LEA and this much more than what has already been experienced (€3).

The use of a Top-Down approach for non-civil engineering assets outside LEA may be considered as inconsistent with the September 2013 European Commission's recommendation.

Option 2 nationally averaged price

Option 2 minimises the risk of digital divide by setting the same price across the whole national territory.

- The copper cables in the LEA are likely to be replaced, at least on the E-side. That is why a bottom-up approach is relevant. Outside the LEA, where no NGA investment is likely, there is no need to calculate the cost of renewing cables. It is sufficient to set the same price as in the LEA. Such an approach will not facilitate sending the correct build-or-buy signal but this is not needed outside the LEA. This way, in the LEA, the bottom-up approach respects the criteria of sending a correct build-or-buy signal, ensuring consistency across investment ladder.
- For products that are also sold nationally (such as Naked DSL or SB-WLR) and not only in LEA (such as LLU), since sending signals to incentivise investment in alternative infrastructure is less relevant, Eir should be allowed to recover its actual top-down costs under option 2.

It is important to note that this approach is not inconsistent with the September 2013's European Commission recommendation as this latter does not discuss geographic scope. The philosophy of this option 2 is even closer to the recommendation compared to option 0 in the sense that it precisely links wholesale prices to NGA build or buy signals.

Under both options, it is proposed to calculate costs on an Equally Efficient Operator (EEO) basis:

[75] See section 6.2

[76] See Table 13, there is a €5 difference between the price inside LEA with BU-LRIC with trenches and poles on TD Tilted annuities FAC (11.6) and the price outside LEA with top-down HCA FAC

- such an approach sends the appropriate build or buy signals since the local loop is seen as an essential infrastructure and therefore using a Reasonably Efficient Operator (REO) approach would promote inefficient duplication of the local loop,
- such an approach makes sure that investment incentives for the SMP operator to upgrade or extend the existing network are retained,
- such an approach leads to access price that are more reasonable (lower) than prices based on a REO approach. The latter approach would imply much higher costs than existing prices because of the lower level of economies of scale assumed in the REO scenario.

6.3.2.3 Active assets

SB-WLR and Naked DSL use active assets (line card, backhaul) on top of Eir's copper local loop.

Unlike the civil engineering assets and local loop passive assets, the active assets do not need to be treated differently in "Option 1" and "Option 2" as the same reasoning will apply in both options; specifically, ComReg should encourage OAOs to climb the investment ladder and therefore should send appropriate build or buy signals when setting SB-WLR and Naked DSL products:

- Inside the LEA, OAOs should be encouraged to use the local loop through LLU, SLU (or VUA). This means that the difference between, on the one hand, the price of SB-WLR and Naked DSL and, on the other hand, LLU/SLU prices should be sufficient. Indeed, another type of anticompetitive behaviour that can be adopted by Eir is a margin squeeze between different wholesale products. For example, Eir may want to set a low SB-WLR and Naked DSL prices, so that alternative operators – having no other choice – prefer these services to LLU, SLU and Line Sharing. Consequently, they do not "climb" the ladder of investment, they stay more dependent on the network of Eir, and competition is constrained in the long term. Such behaviour is prohibited by ComReg's decision D04/13: *"In order to comply with the Margin/Price Squeeze Test, the price at which Eircom sells or offers a Downstream Regulated Wholesale Service must be greater than the sum of: (i) the ULMP Cost Stack and (ii) the unavoidable costs of a Reasonably Efficient Operator that must be incurred in order to provide a service equivalent to the relevant Downstream Regulated Wholesale Service"* (see section 4.2), where "ULMP Cost Stack" means the appropriate monthly cost of the ULMP (Unbundled Local Metallic Path, or access to the local loop) component. In accordance with ComReg's decision D06/12, a price based on the BU-LRIC+ costs of a REO operator using LLU should therefore be set.
- Outside LEA, there is no need to send appropriate build-or-buy signals since OAOs can only "buy". However, the risk is that Eir sets excessive prices. In accordance with ComReg's WBA pricing decision (ComReg Decision D11/14), a national cost orientation applies to current generation Bitstream products with a

further cost orientation outside LEA (i.e. Eir should respect the cost orientation obligation nationally and should not be permitted to set prices outside LEA above costs outside LEA).

- Two options can be followed for this cost orientation approach: (i) a top-down approach or (ii) a BU-LRIC+ EEO (Equally Efficient Operator) approach. An EEO has the same cost function as the SMP operator and the same number of customers, so that it benefits from the same economies of scale.
- In accordance with ComReg's WBA pricing decision (ComReg Decision D11/14), a top-down approach could be used. The reason for choosing the top-down methodology as opposed to the BU-LRIC+[77] is mainly due to the fact that in the absence of alternative network competition the BU-LRIC+ approach may result in excessive pricing outside the LEA as it facilitates the recovery of hypothetical costs which may not have been actually incurred. Given the extent of depreciated assets (i.e. DSLAMs, backhaul and BRAS) in Eir's core network and the fact that these assets may not be replaced by Eir, the BU-LRIC+ methodology could give rise to significant increases in prices outside the LEA. This would be detrimental to end-users and OAOs that have no alternative options.
- It is noted that the European Commission's opinion on ComReg's WBA pricing decision[78] is rather against the use of HCA: *"In relation to this, the Commission is concerned that the proposed use of HCA in calculating the cost-orientated price (albeit only as regards core network elements) does not allow the SMP operator a sufficient and stable return on investment Outside the LEA, where it is most likely that the cost-orientation will actually apply. While taking note of ComReg's explanation that no commercial NGA deployment is expected Outside the LEA, the Commission would like to stress the importance of maintaining the correct build-and-buy signals in order not to foreclose potential investment altogether, including from new market players. In this context, the Commission would point to the possible market entry as announced by the electricity distribution operator ESB."*
- In order to be consistent with the European Commission comments and to be able to send right forward looking investment signals for assets with short lifetime (i.e. that needs to be renewed regularly), the BU-LRIC+ approach is therefore recommended for active assets.
- The national cost orientation obligation should apply not only to the active assets but to the full costs of SB-WLR and Naked DSL (i.e. active assets + local loop assets). For SB-WLR or Naked DSL, alternative operators

[77] BU-LRIC+ is equivalent to BU-LRIC with the inclusion of common costs.

[78] Commission Decision concerning Case IE/2014/1571: Wholesale broadband access in Ireland — price control remedies

buy these wholesale products all over the country. As a consequence, the above approach should be complemented by giving the ability for Eir to set the wholesale prices at the level of Eir's national average cost of local loop costs + active asset costs. This is not an issue for LLU because alternative operators are unlikely to buy LLU outside LEA areas[79].

The BU-LRIC+ EEO approach is therefore recommended.

This approach can be combined with both options presented in sections 6.3.2.1 and 6.3.2.2.

NB: It is to be noted that in case the outcome of the proposed approach is a situation where SB-WLR is so high that the retail line rental is no longer affordable outside LEA, then SB-WLR may need to be reduced below calculated costs. In such a case, to avoid under-recovery, bitstream prices (standalone or not) may need to incorporate the loss in the copper local loop on SB-WLR. However, this approach would mean treating SB-WLR and DSL very differently which could provide inappropriate signals. This approach is therefore not considered further.

6.3.3 Recommendations on Cost Standard

In accordance with the conclusions of section 6.1.2, the following cost standard is recommended for each of two modelling approaches:

- FAC approach for the top-down model,
- LRIC approach for the bottom-up model ("BU-LRIC").

6.3.4 Recommendations on the Depreciation Method

For each of two models, bottom-up and top-down, there is a need to define a depreciation method.

6.3.4.1 Top-down

As explained in section 6.1.3, 3 depreciation methods can be identified: HCA, CCA and Tilted annuity, the first two being pure accounting methods.

With regards to the reusable civil engineering infrastructure the European commission favours a top-down approach that includes an indexation method based on an appropriate price index:

[79] About SLU, please refer to section 5.2. SLU may be bought by alternative operators in rural areas as part of the National Broadband Plan but in this case it remains preferable to keep the SLU price at the level of the cost of LEA or at the national cost (which is similar for lines not further than 1.5km from a cabinet) to avoid creating a digital divide.

> "*NRAs should value reusable legacy civil engineering assets and their corresponding Regulatory Asset Base (RAB) on the basis of the indexation method. Specifically, NRAs should set the RAB for this type of assets at the regulatory accounting value net of the accumulated depreciation at the time of calculation, indexed by an appropriate price index, such as the retail price index*."[80]

To ensure exact cost recovery, it is therefore necessary to depreciate the regulatory accounting value net of the accumulated depreciation at the time of calculation (see section 8) over the remaining lifetime of assets. The European Commission seems to recommend however to inflate the Net Book Value by considering the history of retail price index. However, this would generate an over-recovery of costs compared to Eir's actual costs. Also, the European Commission seems to disregard the traditional Top-Down HCA depreciation method because this method does not take into account any index. More theoretically, this method is less relevant for regulatory purposes because it calculates annuities which do not evolve with asset price trends and is therefore not forward-looking. However, the Top-Down HCA is simpler and enables to compare the results with the accounts. The CCA-FCM method and the tilted annuity approach are however compatible with the use of an index and with the valuation of assets which are based on a BU-LRIC+ approach:

- The CCA-FCM method requires the revaluation of assets and this can be done in several ways, including using indexation approaches. This has been for example explained by the ERG to determine how current cost asset values could be calculated: *"The gross replacement cost of an asset can be calculated in a number of ways. The valuation process could use open market value or various forms of indexation"*[81]. This is the approach followed by the Croatian regulatory authority to set LLU prices on the basis of the European Commission recommendation[82]. It is to be noted that the CCA-FCM can be implemented using an index but the annuities calculated with this approach do not increase with the index (see diagram below).
- The tilted annuity method calculates annuities which increase every year with price trends (index). This method is generally used in bottom-up models but has been used by ARCEP in a top-down model since 2005[83].

It should be noted that both CCA-FCM and Tilted annuity ensure strict cost recovery since they are calculated based on the Net Book Value of the assets, derived from Eir's accounts. Both methods take into account an index to calculate depreciation charges.

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[80] European Commission's September 2013 Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment (§34).

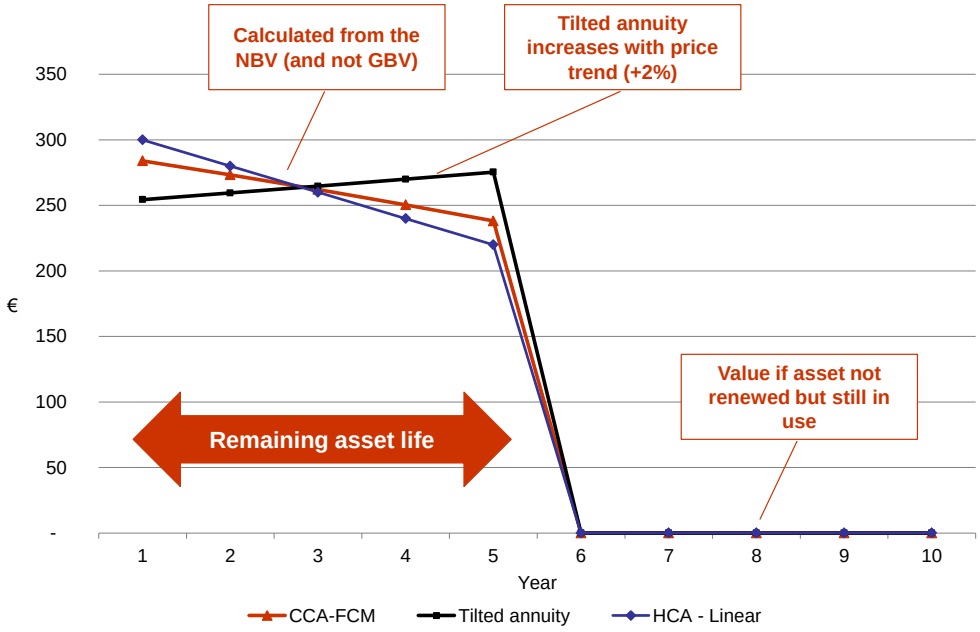
[81] ERG, Guidelines for implementing the Commission Recommendation C (2005) 3480 on Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications

[82] Which was not opposed by the European Commission – see Commission Decision concerning Case HR/2014/1560, 2014

[83] ARCEP decision 05-0834.

While the HCA method would ensure consistency with Eir's regulatory accounts (and therefore it would be possible to verify that charges equal revenues every year), the CCA-FCM or the Tilted annuity methods are also relevant. They also ensure exact cost recovery but with different depreciation profiles (see figure below).

Figure 6. Depreciation profile with HCA, CCA-FCM and Tilted annuity methods (assuming a 2% index)



Source: TERA Consultants

As a conclusion, when applying a Top-down approach in combination of the BU-LRIC+ approach for some assets, the CCA-FCM or the tilted annuity methods are recommended. There should be a preference for the tilted annuity method as this would provide consistency with the method selected for bottom-up models (see below). The Top-down HCA approach can be relevant to ensure strict cost recovery of actual costs and easy comparison with the SMP operator's annual accounts.

6.3.4.2 Bottom-up

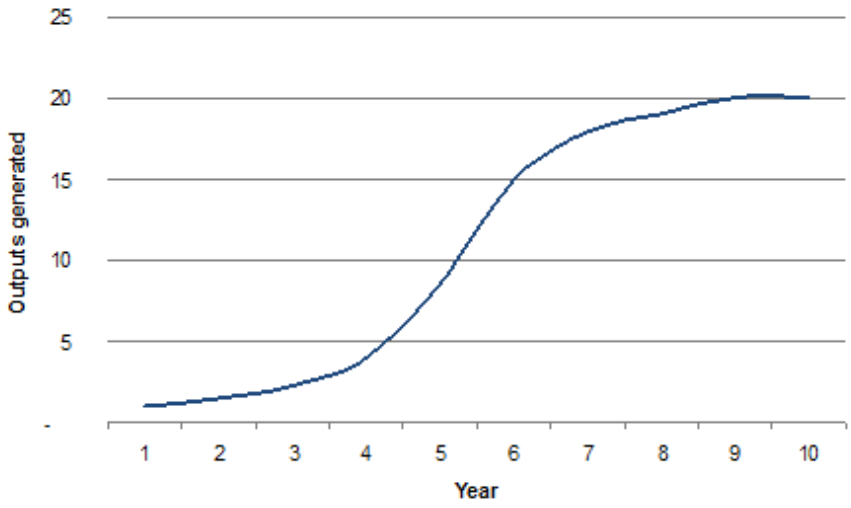
For the bottom-up model, as explained in section 6.1.3, the choice between three methods is generally made: standard annuity, tilted annuity, economic depreciation. Standard annuity is not appropriate since it does not take into account the price trend. Tilted annuity takes into account asset price changes but does not factor in volume movements. The economic depreciation takes into account both asset price and volume changes. The last approach should be preferred if it is decided that the change in volume is important.

The product volume is expressed in our case in the number of lines active on the modelled network.

Two approaches can be envisaged:

- Assume that all the consumers that are currently connected to the legacy network switch to the NGA network once it is constructed.
- Assume a take-off period, during which consumers migrate to the NGA network progressively.

Figure 7. Example of a take-off period



Source: TERA Consultants

These approaches only change the calculation of E-Side cable costs since this is the only network element impacted by the migration from copper to NGA in Ireland.

According to the European Commission's September 2013 recommendation, a single efficient NGA network should be modelled that serves both copper and NGA lines. There is no need to distinguish between these two technologies since the copper access price is calculated from the bottom up model of the fibre network. It is explained by the European Commission:

> *"Active copper lines are decreasing due to customers migrating to cable, fibre and/or mobile networks. Modelling a single efficient NGA network for copper and NGA access products neutralises the inflationary volume effect that arises when modelling a copper network, where fixed network costs are distributed over a decreasing number of active copper lines. It allows for progressively transferring the traffic volume from copper to NGA with deployment of and switching to NGA. Only traffic volume moving to other infrastructures (for example cable, mobile), which are not included in the cost model, will entail a rise in unit costs".* (European Commission's 11th of September 2013 recommendation)

In Ireland, copper volumes are decreasing due to competition from UPC. As shown on Figure 2, page 22, UPC's market share in the number of fixed broadband subscribers has increased from 24% to 29% between Q4 2011 and Q4 2013. If it is decided that it is relevant to consider this evolution, then the economic depreciation method should be used. Otherwise, the simple tilted annuity should be used.

For the bottom-up model, either tilted annuity or economic depreciation is preferable. Given the low difference between the two approaches and given the higher simplicity of the tilted annuity approach, this approach should be preferred.

6.3.5 Conclusion and results

The proposed access pricing approaches are practical and proportionate. They are proportionate because they do not exceed what is necessary to achieve the objectives of ComReg. The action is necessary to achieve the desired result: a more consistent regulatory approach in line with the last European Commission's recommendation. As explained in this report, the proposed measures are suitable for the achievement of the objectives of ComReg.

The proposed regulatory measures may impose a burden on stakeholders. TERA is of the view that the proposed access pricing approaches are not overly burdensome to implement. In fact, they are not more burdensome than the costing approach previously used.

The two options that are thus considered are summarised in the table below:

Table 16. Two options studied by TERA Consultants for costing approach[84]

Regulatory options	(Reusable) Civil engineering assets		Other local loop passive assets (i.e. copper cables and non-reusable civil engineering assets)	
	LEA	Outside LEA	LEA	Outside LEA
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	Average **top-down** FAC cost of an average line **in the LEA.** Depreciation based on tilted annuity.	Average **top-down** FAC cost of an average line **outside the LEA.** Depreciation based on tilted annuity.	Price paid by alternative operators: equal to the average **bottom-up** LRIC cost (with tilted annuities) of an average line **in the LEA** paid by alternative operators	Average **top-down** FAC cost of an average line **outside the LEA**, (potentially reduced thanks to the margin generated by Eir in LEA because of bottom-up LRIC being potentially above Eir's costs)
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up (and Eir's actual top-down costs for products sold outside LEA)	Average **top-down** FAC cost of an average line (in the LEA). Depreciation based on tilted annuity.		Average **bottom-up** LRIC (with tilted annuities) cost of an average line (in the LEA).	

Source: TERA Consultants

Finally, for both Option 1 and Option 2, active assets used by SB-WLR and Naked DSL on top of the copper local loop should be valued on a bottom-up basis of a REO operator buying LLU in LEA areas. Such an approach encourages operators to use LLU rather than relying on SB-WLR or Naked DSL. However, to make sure that prices are not excessive outside LEA where such a pricing approach (respect of the investment ladder) is not relevant, a national cost orientation approach should apply similar to that in place for WBA services. The national cost orientation obligation should apply not only to the active assets but to the full costs of SB-WLR and Naked DSL (i.e. active assets + local loop assets). Indeed, with Option 2, the local loop costs are only based on LEA costs. Therefore, for those products (i.e. SB-WLR and Naked DSL) that are also sold outside LEA (i.e. in areas which can be very expensive and where it is less relevant to send incentives to invest in alternative infrastructure), it can be relevant to consider Eir's actual top-down costs under this option.

[84] In this section areas where investment in wired access network infrastructure is likely are assumed to be LEA areas (see section 5.2)

Table 17. Costing approach for active assets under both options considered

Regulatory options	(Reusable) Civil engineering assets	Other local loop passive assets (i.e. copper cables)	Active assets (for SB-WLR and Naked DSL)	
			LEA	Outside LEA
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	See above		Average bottom-up LRIC cost of a REO	Floor set on the basis of the costs of buying LLU in LEA areas + national cost orientation obligation.
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up (and actual top-down costs for products also sold outside LEA)				

Source: TERA Consultants

The main advantages and drawbacks of each option are summarised in the table below:

Table 18. Advantages and disadvantages of the 2 options identified by TERA

Regulatory options	Advantages	Disadvantages
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	• Ensure cost recovery for Eir • Send appropriate build or buy signals	• Is not fully consistent with the European Commission recommendation • Geographic de-averaging but there is already some geographic de-averaging in place • Outside LEA, SLU and duct access prices will be higher than in LEA and this could be negative for the National Broadband Plan
Option 2: nationally averaged price with civil engineering in top-down and other assets in bottom-up where Eir's actual actual costs are considered for products also sold outside LEA	• Is consistent with the European Commission recommendation • No geographic de-averaging • Send appropriate build or buy signals • Cost recovery is ensured for products sold outside LEA since Eir's actual top-down costs are also considered for these products	

Source: TERA Consultants

7 Potential price decrease by Eir

This section presents solely TERA Consultants economic point of view and <u>does not provide any legal view</u> on the possibility for Eir to lower prices.

The wholesale access price level may serve either as an absolute price level or as a maximum price:

- In the first case, the wholesale access price must be strictly equal to the regulated level.
- In the second case, the regulated operator may set any wholesale access price that does not exceed the regulated level.

In certain geographic areas (for example, in a particular exchange), following strong competition from an alternative operator who has constructed its own network, Eir may want to decrease its retail prices to be able to compete. This section thus deals with the economic argument regarding the possibility of a decrease in wholesale prices for Eir.

It is important to understand that the issues that arise due to a decrease by Eir of its wholesale access prices below the regulated levels could only be dealt with *ex post*. Indeed, one could argue that ComReg does not need to introduce new rules for such cases and *ex ante* remedies are not needed. However, in a context where significant investment in NGA will happen in the coming years, it is important to provide visibility and certainty to each stakeholder, especially those that intend to deploy NGA, including Eir. Leaving such issues to *ex post* assessment could be problematic and generate uncertainty, which would then dis-incentivise investment, as an *ex post* assessment can be long and complex. As a consequence, TERA Consultants believes that *ex ante* rules are required.

7.1 Solution 0: Eir is not allowed to set prices below the regulated levels

It is not always desirable that Eir should be permitted to cut prices following a cut in prices by a new entrant. In fact, in a report prepared for ComReg on Eir's bundles assessment, Oxera explains that a new entrant may need to set prices lower than Eir by the amount of the switching costs perceived by end customers. In addition, a new entrant may need to set a lower price to compete with the well-known brand of the incumbent before its own brand becomes well-established. Finally, a new entrant may need to price at a loss in order to quickly gain market shares and the corresponding economies of scale.[85]

[85] Oxera. Conceptual framework for the assessment of Eircom's bundles. Adjustments to the net revenue test. Updated report prepared for Commission for Communications Regulation to inform Decision. February 2013

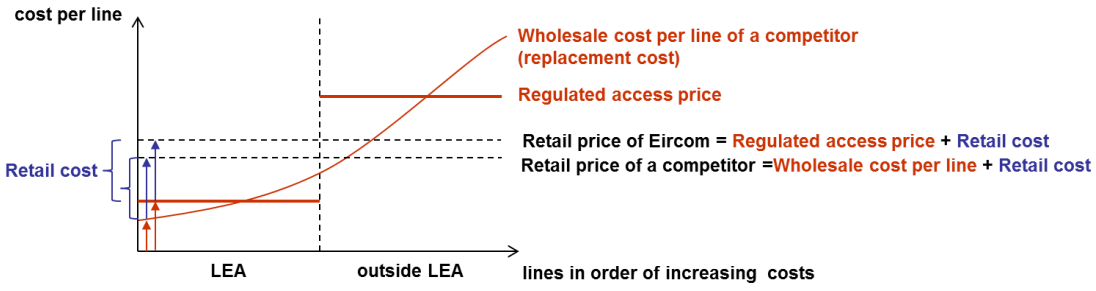
Eir may also use its freedom of setting the access price below the regulated level in order to foreclose a competitor. Consider an OAO who wants to invest in its own infrastructure. It chooses an area where it is profitable, given consumers' demand and current wholesale access price. Once the OAO has started to deploy the network, Eir may significantly decrease retail price in order to prevent the deploying operator from obtaining the expected level of profit. To avoid margin squeeze, Eir will also have to decrease the wholesale access price to compete. This way, Eir would start intensive price competition only in exchange areas where an alternative operator starts to deploy. If the alternative operator continues to deploy, the project is unprofitable. If an alternative operator abandons the exchange, Eir may increase the price to the previous level. Such predatory pricing risk will discourage any investment by an alternative operator. The reputation effect is in place: an OAO will learn from the previous experience and will decide not to start deployment in new exchanges.

As a conclusion, there are some economic arguments to forbid Eir to lower its wholesale access price below an acceptable level (or price floor), but no clear-cut economic argument justifying that wholesale access price should be strictly equal to the regulated level. This is why "solution 0" is not recommended.

Forbidding Eir to lower its wholesale access price whatever the local competition context may lead to inefficiencies and is not consistent with the "competition" and "consumer" objective for ComReg.

In fact, as shown on the graph below, since the access price is averaged (either on the whole national territory or on a part of the territory) it will be higher than the cost in the least expensive areas. As a consequence, Eir should be able to lower its wholesale price to compete with the retail price offered by alternative operators (and thus avoid creating a margin squeeze). This ensures a good competitive pressure between Eir and the other alternative operators.

Figure 8. Retail price competition under access price regulation



Source: TERA Consultants

As the role of regulation is not to prevent SMP operators from competing with its competitors but to enable OAOs compete with SMP operators, Eir should be allowed to price below regulated access prices in certain circumstances. Indeed, preventing Eir from competing with alternative infrastructure (such as UPC) as long as it has SMP (because when it does not have SMP anymore, it becomes free to act) would not be pro-competitive since all OAOs relying on Eir's infrastructure would not be able to compete as well.

In conclusion, there are some economic arguments to leave room for Eir to lower its wholesale access but this must be justified by the local competition context. As a consequence, a regulatory approval mechanism has been identified and is described below.

This is without prejudice to an *ex post* assessment of predatory pricing, although TERA Consultants believes they are complementary, especially as an *ex post* assessment of predatory pricing takes time to conduct and assess.

7.2 Solution 1: "Regulatory approval" mechanism

It is possible to imagine the following solution that aims at favouring price competition and at the same time avoids predatory pricing by Eir. A "regulatory approval" mechanism may be set up, whereby Eir asks ComReg to decrease wholesale access prices in a given geographic area so long as it does not price below a specified price level / floor. To be able to reduce prices, Eir has to justify, using an *ex ante* margin squeeze test, that the alternative operator's retail price is non-replicable otherwise. Similar mechanisms have already been introduced:

- ComReg's margin squeeze tests for NGA offers[86] has a similar mechanism since it allows Eir to lower its wholesale prices if retail prices need to be decreased;
- In France, for leased lines above 10 Mbps, ARCEP prevents Orange from setting its wholesale prices below a level which would evict alternative infrastructures. This is called the "non eviction" obligation[87].

This margin squeeze test should respect the rules determined by ComReg in other decisions regarding margin squeeze (see section 3.2.2). Let us take several examples (all prices are VAT excluded in the examples):

- Eir proposes a 50 Mbps broadband offer at a retail price of €40 per month. The wholesale access price is €10 and the margin squeeze test defined by ComReg for this offer shows a margin of €1.
- First example:
    - An alternative operator having a wired NGA infrastructure (FTTH, FTTC or coax) launches two offers:
        - One for €40 at 100 Mbps;
        - One for €39 at 50 Mbps.
    - In this case, Eir would not be allowed to reduce the wholesale access price but to lower its margin to be able to meet the €39 price point;
- Second example:

[86] ComReg Decision D03/13

[87] See ARCEP recent decision N° 2014-0735 of the 26th of June 2014

- An alternative operator having a wired NGA infrastructure (FTTH, FTTC or coax) launches two offers:
  - One for €40 at 100 Mbps;
  - One for €35 at 50 Mbps.
- In this case, Eir would be allowed to reduce the wholesale access price by €4 to be able meet the €35 price point;

- Third example:
  - An alternative operator having a wired NGA infrastructure (FTTH, FTTC or coax) launches one single offer:
    - One for €35 at 100 Mbps;
  - In this case, Eir would be allowed to reduce the wholesale access price by €4 to be able meet the €35 price point;
  - It is noted that in this case, Eir's offer would be less attractive (50Mbps versus 100Mbps) but this would force Eir to improve its quality of service.

This mechanism helps alternative operators to plan their investment. If Eir's access price decreases, it is only done after a retail price decrease from one of the alternative operators. Consequently wholesale access prices should be more predictable for OAOs. This could limit the risk of a price war on retail prices, which has some benefits in the short term for end-users, but can be detrimental in the longer term for investment.

Under this proposed mechanism, Eir may have to decrease prices of all the wholesale services at the same time to ensure consistency across the ladder of investment. This means that, to keep an economic space between the different steps of the ladder of investment, SLU and duct access prices will also have to decrease.

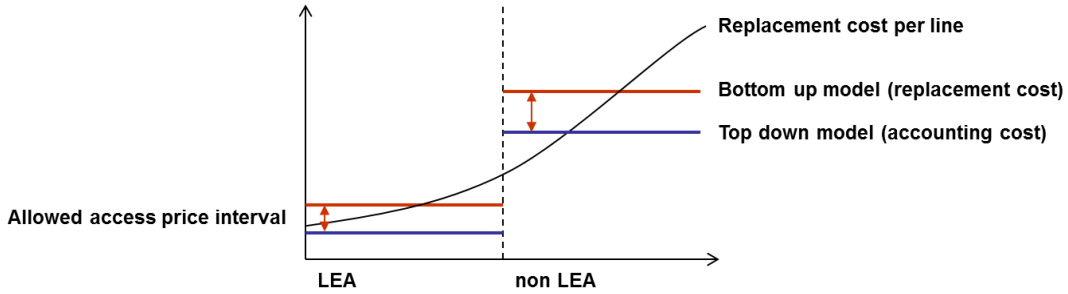
Such a mechanism will avoid situations where Eir introduces temporary price discounts in a given geographic area in order to foreclose a competitor from the market or in order to encourage bitstream services at the expense of WPNIA services.

In doing so, Eir could not set the proposed price below a price floor, so that the access prices remain within a given interval[88]. A geographically de-averaged price floor may be set at the level of the HCA cost estimated from the top-down model for WPNIA products in the considered area (a geographically average price floor would not reflect local costs).

[88] However, setting a price floor does not solve completely the risk of the margin squeeze. The margin squeeze between different wholesale services across the ladder of investment is still possible: if the price is decreased to the price floor level for Naked DSL and not for LLU, LLU investment for alternative operators is unprofitable. This means that the price of all products present in the value chain must be decreased. In addition, wholesale access price movements inside the authorised price interval cannot be predicted by alternative operators, which leads to instability and difficulties when making an investment plan.

This way, Eir would be forbidden to set costs below its accounting costs in the area. It is a standard test for the predatory pricing[89].

Figure 9. Introducing an access price floor



Source: TERA Consultants

Detailing how the "regulatory approval" mechanism should be implemented is out of scope of this report, but ComReg could leverage on its experience with the price regulation of bundled offers[90] that requires Eir to comply with an *ex ante* margin squeeze test:

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[89] In its guidelines on the Article 82 (now 102) of the EC Treaty, the European Commission explains that the predation test that compares costs with prices may be done with respect to two cost references both based on top-down information: AAC (incremental cost) and LRAIC (incremental cost plus fixed cost):

> *"The cost benchmarks that the Commission is likely to use are average avoidable cost (AAC) and long-run average incremental cost (LRAIC)."*
>
> *"LRAIC is usually above AAC because, in contrast to AAC (which only includes fixed costs if incurred during the period under examination), LRAIC includes product specific fixed costs made before the period in which allegedly abusive conduct took place." (*§26)

Therefore, two levels of test can be done:

> *"Failure to cover AAC indicates that the dominant undertaking is sacrificing profits in the short term and that an equally efficient competitor cannot serve the targeted customers without incurring a loss."* (Predation is proven)
>
> *"Failure to cover LRAIC indicates that the dominant undertaking is not recovering all the (attributable) fixed costs of producing the good or service in question and that an equally efficient competitor could be foreclosed from the market."* (To prove predation, additional arguments need to be found)

In the case of the local loop, AAC is close to zero (or at least Eircom's OPEX) and LRAIC is equal to the full local loop. As a consequence, on an *ex ante* basis, setting a floor at the level of AAC may provide too much flexibility to Eircom in the area where Eircom wishes to decrease access prices. As a consequence, setting a floor at the level of LRAIC would therefore be more relevant to provide price stability and certainty to stakeholders.

[90] Price Regulation of Bundled Offers, Further specification of certain price control obligations in Market 1 and Market 4, Response to Consultation and Decisions, Ref: Document 13/14 & Decision D04/13, 08/02/2013 (p. 103).

- Notification and pre-clearance process, whereby "*Eircom must notify and obtain prior approval for the launch of new or revised* [offers] *at least five working days before launch*."
- Final approval, whereby "*Eircom must withdraw / modify any existing [offer] that is found to be non-compliant within twelve weeks. Within that period, (…) Eircom would be prohibited from adding any customers to the [offer] unless and until such* [offer] *was modified to ComReg's satisfaction*."

In any case, it would be Eir's commercial choice if it wished to decrease wholesale access prices but Eir would be obliged to ask ComReg for approval and provide adequate justifications for this.

7.3 Conclusion on lowering prices

If Eir wishes to lower its prices below the cost-oriented level set by ComReg, TERA Consultants believes that it is economically efficient for ComReg to oversee such action as other alternative operators require a stable price to deploy their own alternative infrastructure. Otherwise, this would create too much uncertainty because such cases would be left to *ex post* assessment which can be long and complex.

It is thus recommended to introduce a "regulatory approval" mechanism, whereby Eir may ask ComReg to decrease access price in a given geographic area so long as it does not price below the price floor. To do so, Eir has to justify, using a margin squeeze test, that the alternative operator's retail price is non-replicable otherwise. ComReg will also consider Eir's local HCA costs. Eir may have to decrease prices of all the wholesale services at the same time to ensure consistency across the ladder of investment. Such a mechanism will avoid situations where Eir makes temporary price discounts in a given geographic area in order to foreclose a competitor from the market or in order to encourage bitstream services at the expense of WPNIA services. This provides further assurance to OAOs wishing to invest in alternative wired access network infrastructure because they know that their business plan will be affected only if their own retail price decreases to a certain level[91].

It should be noted that the proposed regulation would not replace the *ex post* regulation: an alternative operator can still file a complaint with the Competition Authority if it judges that Eir's access price is predatory or causes a margin squeeze.

Such an approach is pro-competitive since it provides more flexibility to Eir, more ability to compete but also more certainty for OAOs.

[91] They could still be affected by the decrease in retail prices of other alternative infrastructure but these are not regulated.

8 Assumptions relevant to the implementation of the proposed cost model

8.1 Appropriate timeframe

It is necessary to determine the appropriate timeframe over which the prices should be set.

The recommended timeframe for setting the access price level is 3 years which ensures a sufficient regulatory predictability. This period provides sufficient time for the development of the market for wholesale products, infrastructure investment by alternative operators. Alternative platform providers (for example UPC) will also be provided with a degree of certainty in relation to wholesale products market development.

At the end of this period, if market review maintains the price control obligation, it is recommended to recalculate wholesale access prices by updating the costing model and not changing the costing methodology.

It is consistent with the non-discrimination recommendation of the European Commission:

> *"When implementing the recommended costing methodology or alternative costing methodologies that comply with points 40 and 44, and the NRA maintains the methodology in line with point 46, NRAs should only update the data input into the costing methodology when conducting a new market review, in principle after three years. When updating the model, the NRAs should in principle, and provided that market conditions have remained stable, only adjust such data in line with the real evolution of individual input prices and should in any case ensure the full recovery over time of the costs incurred to provide of the regulated wholesale access services. NRAs should publish the updated outcome of the costing methodology and resulting access prices over the relevant three-year period". (§47)*

8.2 Price Trend

As stated in 6.1.3, the recommended depreciation method is the tilted annuity approach. This method takes into account asset price trends: the annuity of the last year of an asset lifetime is close or equal to the annuity of the first year after the asset renewal. This helps to minimise discontinuity in the calculation of unit costs at the moment of asset renewal (as explained more in details in the Annex, section 11.2 and especially Figure 17).

To account for the price trend, it is possible to simply take a general inflation index, such as consumer price index, and to apply it to all the assets. However, the real price index differs significantly between assets: if the cost of civil engineering is increasing over time following an increase in the average salary, the cost of active equipment may be

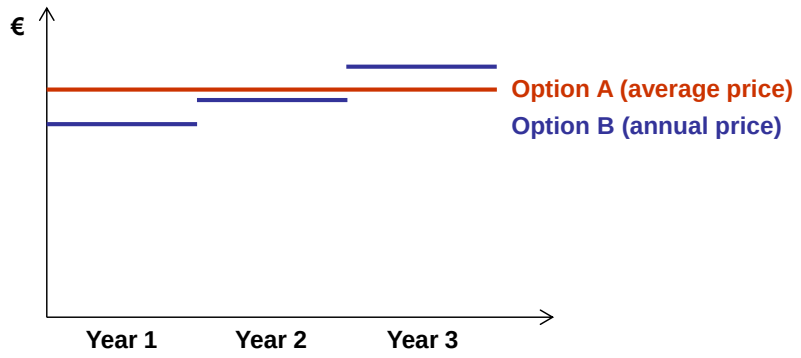
decreasing with the development of technological progress. That is why using a general inflation index is not recommended. It is preferable to use a set of specific price trends for the different cost components.

The European Commission's September 2013 recommendation states that: "*Specifically, NRAs should set the RAB for this type of assets at the regulatory accounting value net of the accumulated depreciation at the time of calculation, indexed by an appropriate price index, such as the retail price index".* This would tend to mean that a retail price index should be used (even if this is only given as an example since the European Commission says "such as"). However, using a retail price index rather than an asset specific price index can provide instability in the long term because, when assets need to be renewed in the long term, the cost to renew can be significantly different from the corresponding existing price (costs and prices will have evolved very differently). In other words, using asset specific price index enables the setting of regulated prices which follow the evolution of network asset prices and therefore provide better "build or buy" signals.

Also, as a result of a price trend application and of variations of annuities from one year to another, the cost calculated by the copper access model will differ from one year to another. A question arises at what level the access price should be set. Two approaches are possible:

- Price trend approach #1. Access price equal to the cost in the middle of the control period or to the average cost over the control period.
- Price trend approach #2. Access price growing each year in line with cost growth. Access price level of each year is set by ComReg at the beginning.

Figure 10. Price trend treatment: two approaches



Source: TERA Consultants

Both options guarantee a sufficient regulatory stability since in both cases all the operators know the access prices in advance: both options provide visibility to potential investors.

In conclusion, TERA recommends using a set of specific price trends for different cost components.

8.3 Efficiency adjustments

Efficiency adjustments are performed to ensure that no "undue inefficiencies" are recovered by Eir. "Undue inefficiencies" are related to areas where Eir could realistically improve its efficiency (for instance, inefficiencies solely related to the legacy network that was efficient in the past but became inefficient over time are not considered). Efficiency adjustments are thus relevant for OPEX as copper access network assets cannot undergo any realistic and reasonable efficiency adjustment (it is reasonable to assume that the network, at each point in time, has been deployed efficiently, having taken into account the history of the network – it is even probably unfeasible to identify inefficiencies).

In a bottom-up approach, efficiency adjustments are inherently taken into account to dimension the network and calculate CAPEX. With respect to OPEX, efficiency adjustments are performed by assessing the Line Fault Index (LFI) of a new network and potentially reducing the required staffing levels consequently. This was the approach followed by ComReg previously[92].

In a top-down approach, an efficiency adjustment can also be performed based on the LFI. This has already been performed for the USO in the past, as outlined in the non-public document by WIK related to USO Modelling for Financial Year 2009/10 ("Detailed Model Methodology"): ✂

Such an efficiency adjustment could therefore be implemented in the Top-Down model but it appears that the impact of such an adjustment remains very low.

With respect to efficiency and more generally service performance, it could be imagined to set differentiated prices depending on the level of service performance: for example access prices within areas with a high LFI would be lower, all other things being equal, than access prices within areas with a low LFI. This would be equivalent to defining a gradient which sets different prices for different offers with different level of quality of service. This gradient could be set by defining a monetary value corresponding to the inconvenience of bearing a fault and therefore of not being able to use the service. For example, if the monetary value is €50 and the national LFI is 5% but the LFI in the area is 10%, then the discount on access prices in areas with a high LFI would be: 50x(10%-5%)/12 = €cts 20 per month. This approach would give incentives for Eir to increase service performance. This would also probably decrease prices in rural areas (as rural areas are generally experiencing more faults due to the fact that cables are installed on

[92] ComReg Decision D01/10.

top of poles). However, this approach has some drawbacks: first of all the monetary value is difficult to assess and second it would be much simpler to define a penalty when a fault occurs, as it sometimes applies for wholesale offers.

8.4 Main Assumptions of the Top-Down Model

TERA has recommended that reusable civil engineering assets are priced based on a top-down model.

As explained in Annex, Section 11.1.2, European Commission recommends valuing reusable civil engineering assets following two steps:

- First, NRAs should lock-in the RAB (Regulatory Asset Base[93]) corresponding to the reusable legacy civil engineering assets;
- Second, it should be rolled forward from one regulatory period to the next on the basis of the indexation method.

As explained in 6.3.4, the second step means applying a price trend when calculating depreciation. Here we discuss the first step in more details: what is today's assets net value (or "RAB") to be taken as a base. The method ensures that operators are not recovering more than what they invested in the past only if the net value is properly calculated.

The concept of RAB is central for utility pricing, especially in UK but also in other countries: "*Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands and Spain all have electricity and gas network RABs for electricity and gas transmission/transport although in several cases, the companies are fully state-owned"* [94]*.* Prof. Jon Stern[95] explains that in most cases, the net book value calculated from the company's accounts is the same as the RAB. They are different only if the assets are sold at a discount at privatization, which is not the case in Ireland. [96]

Therefore, it is recommended to set the net value, or RAB value of civil engineering assets, equal to the net book value in the accounts of Eir. The net book value is equal to its acquisition cost minus all the depreciation charges already made over the past lifetime of an asset.

[93] The RAB emerged during the 1990s in the UK after privatization of the main network infrastructure industries. It was initially developed for the England and Wales water industry, but its use spread to UK energy, to railway networks and to the fixed line telecom network.

[94] Jon Stern, The Role Of The Regulatory Asset Base As An Instrument Of Regulatory Commitment, CCRP Working Paper No 22, March 2013

[95] Jon Stern, The Role Of The Regulatory Asset Base As An Instrument Of Regulatory Commitment, CCRP Working Paper No 22, March 2013

[96] Eircom was formed in 1984, as Bord Telecom Éireann, under the Posts and Telecommunications Act 1983. Later it has been privatised: the process began in 1995, and by July 1999 the government had disposed of virtually all of its shareholding.

An advantage of this method is simplicity, consistency with the accounts and with the European Commission's recommendation. It should be pointed out that depreciation of these assets should be calculated over their remaining lifetime.

In conclusion, the standard approach where today's asset net value is equal to its accounting net book value should be preferred.

For reusable civil engineering assets that Eir is purchasing in the future (new trenches, new poles, new chambers, etc.), they should be included in the Regulatory Asset Base and be depreciated over their economic lifetime using the same approach as the ones already in the Regulatory Asset Base.

8.5 Main Assumptions of the Bottom-Up Model

The bottom-up model will be used to calculate the cost of assets other than civil engineering. It constructs a network of a hypothetical operator. Several important decisions should be made with respect to this model:

- How to allocate costs between different access services?
- The extent to which the rebuilt network resembles Eir's network (scorched node or scorched earth approach);
- Relevant technology.

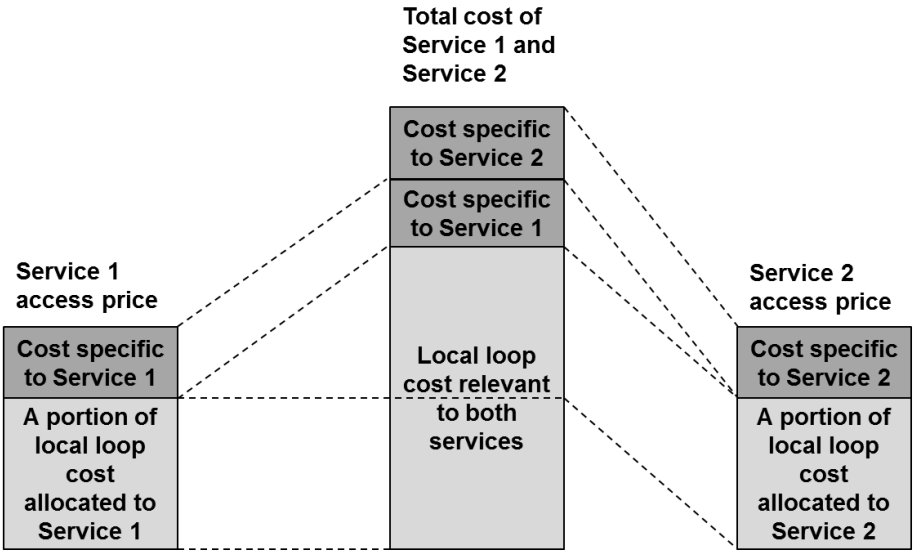
8.5.1 Cost Allocation

8.5.1.1 Allocating costs between different access services

It is possible that two access services are provided through one consumer line, in which case it is necessary to define a rule to allocate costs relevant to both services.

Consider Service 1 and Service 2 that share one consumer line. The cost base consists of two cost categories: cost specific to each service, such as administration and billing, and local loop cost shared by both services. A rule should be used to define the proportion of the common local loop cost allocated to each service. The access price of each service will be equal to the service-specific cost plus a share of the local loop cost allocated to this service. This is shown in the figure below.

Figure 11. Allocating costs between complementary access services



Source: TERA Consultants

This issue is relevant for Line Share and SB-WLR as the same line is used to support internet and voice services. Consequently there is a need to allocate the local loop cost between these services. When defining a rule, it is necessary to ensure that the totality of costs is recovered.

Under the current regulation, the Line Share price is equal to the incremental cost. It means that no local loop cost is allocated to the Line Share service and its access price is oriented towards the costs specific to Line Share: administration, billing etc.

In the report on Line Share pricing in Ireland, TERA has explained that such an approach is economically efficient. Owing to the apparent lower price elasticity of PSTN and the apparent higher price elasticity of broadband, this approach should lead to an allocation consistent with the Ramsey-Boiteux pricing rule, which provides allocative efficiency in theory.[97] The main idea behind the Ramsey-Boiteux pricing rule is quite simple: when several services use a unique asset, a smaller part of their common costs should be allocated to the service that is more price-sensitive (internet access in this case). Thus, the total demand for services supported by the common asset will be maximised.[98]

In addition, any allocation of the local loop costs to the Line Share service would require a reduction of the incumbent's PSTN monthly rental charge in order to avoid over-recovery of costs. If such a scheme were implemented, consumers not subscribing to

[97] TERA Consultants. Methodology for Line Share Pricing in Ireland. A report prepared for ComReg. 23rd December 2008

[98] Lafont and Tirole (2000) explain the Ramsey-Boiteux Pricing rule as follows: "It would be absurd (on efficiency grounds) to charge high mark-ups on those services for which consumers are not willing to pay much above the marginal cost. Cost recovery should place a higher burden on those services with relatively inelastic demands." "The structure of mark-ups must thus reflect the structure of demand elasticities. Furthermore, the cross-elasticities must also be accounted for." Lafont J.-J., Tirole J. (2000) 'Competition in telecommunications', MIT Press.

broadband services would be paying a higher price for PSTN rental charge than broadband users, which would make such a scheme difficult to implement.

Following these arguments, TERA Consultants recommends maintaining the current costing approach for Line Share: an incremental approach calculating only costs directly related to this service and allocating shared costs to the SB-WLR service. This is also in line with the traditional pricing approach in Europe which consists in retail line rental prices being rebalanced (i.e. the line rental recovers access costs, see section 3.2.2).

8.5.1.2 Allocating costs between the core network and the access network

Certain civil engineering assets are used for both copper cables belonging to the access network and cables belonging to the core network. In this case, an allocation key is needed to separate civil engineering asset costs and allocate them to the different networks. In the former BU-LRAIC+ model developed by ComReg, duct and trench costs are equally distributed between core and access cables when duct and trenches host both networks. For consistency purposes, it is proposed to continue to use this approach. An alternative approach would be to allocate cost between core and access networks on the basis of the size (diameter) of cables used by each network (this approach is called the cross sectional approach).It is noted that in Eir's regulatory accounts, shared duct costs are allocated on the basis of the relative number of cables sharing the route: this is a third option available.

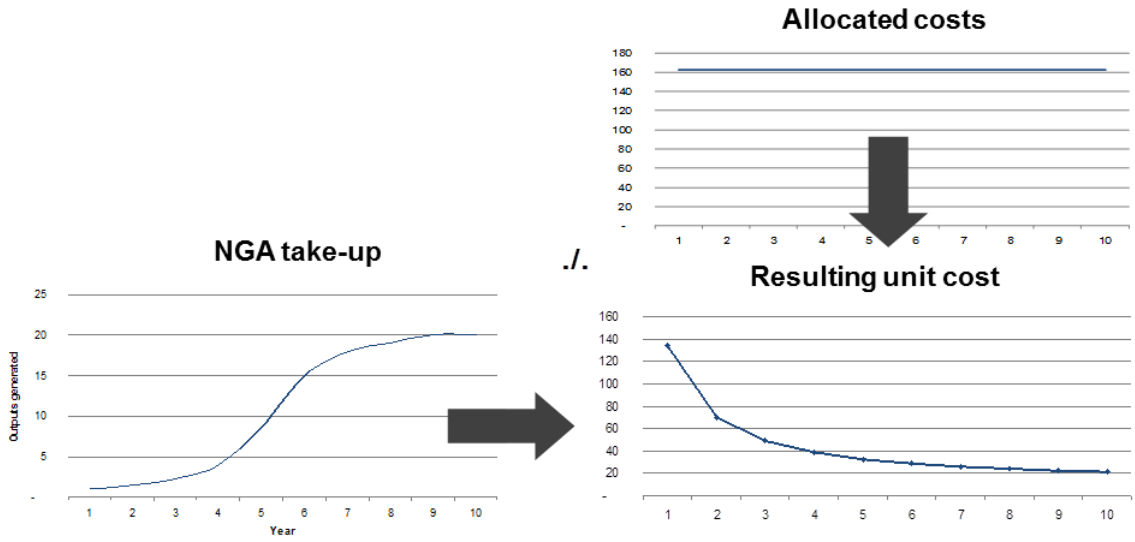
8.5.1.3 Allocating costs between the cables used by fibre leased lines and copper

To ensure consistency with leased lines pricing, it is proposed to allocate cost between cables used by fibre leased lines in the access network and the copper access networks on the basis of the size (diameter) of cables used by each network (called cross sectional approach).

8.5.1.4 Allocating costs between E-Side fibre cables and D-Side fibre cables and more generally between copper access cables and NGA cables

Like in other cases, several approaches are possible: half of costs allocated to each type of cables, cross sectional approach, etc. However, in the migration from copper to NGA, these allocation rules can generate discontinuities in regulated prices because NGA networks have a low number of customers at the start of their life when allocated costs can be important.

Figure 12: Example of unit cost discontinuity due to NGA take-up



However, in the migration from copper to FTTC, only the E-Side part of the trench network will be affected. As a consequence, in order to simplify the allocation mechanism, it is proposed to allocate civil engineering costs between legacy and copper cables on the size of cables.

8.5.2 Scorched Node or Scorched Earth Approach

In bottom-up models, one key network design assumption is related to the question of whether (and if so, to what extent) the existing network topology should be taken into account. Two approaches regarding the location of network nodes are usually proposed: “scorched node” and “scorched earth”. They are defined as follows:

- the scorched node approach uses the location of the existing network nodes and then builds an optimised network within the constraint of those existing nodes,
- whereas the scorched earth approach (also called a “Greenfield” approach) tends to build an ideal topology that is unconstrained by the existing network.

For a fixed network, choosing a “scorched node” approach means keeping the existing exchange location as an input for the model.

The scorched node approach is often preferred by NRAs. For example, the ERG strongly supported the scorched node approach on pragmatic grounds:

> “*Designing an optimal network topology is not a straightforward task. For feasibility reasons, it is appropriate to take the existing network topology as the starting point for the cost allocation process. Such a scorched node approach would imply that the existing points of presence are maintained but that*

technologies are optimised consistent with there being an actual or potential new entrant or efficient competitor[99]."

The scorched node approach should be used because it is based on a more achievable and realistic level of efficiency. This approach has been used in the previous Copper Access Model.[100] In practice, it means that the real geographic coordinates of Eir's exchanges and cabinets will be used. However, there are some cases where it is very obvious that node locations should be moved slightly (either because the subsequent history implies that they would be located elsewhere or because the data of the SMP operator is not sufficiently accurate). In such a case, the scorched node approach should be renamed "modified" scorched node approach.

8.5.3 Relevant Technology

8.5.3.1 WPNIA assets

In order to model the network of an operator, a key choice relates to the technology to be modelled. This question encompasses a set of technological issues that aim to define modern standards for delivering services. Proven, available and least costly technologies should be used in the model as this facilitates the calculation of efficient current costs.

In the bottom-up approach, assets are valued based on the cost of using a Modern Equivalent Asset (MEA) built with the most efficient technology available.

According to the European Commission's September 2013 recommendation,[101] the bottom-up model should be based on an NGA network since an NGA and not a copper network will be constructed by alternative operators, so that it sends the correct build-or-buy signal. However, the European Commission does not give more precise recommendations on what is the modern equivalent asset for copper in order to respect the technological neutrality principle, which can be a Fixed Wireless Access (FWA, which can rely on a standard mobile network), or a FTTC or FTTH network.

Analysis of FWA as the MEA

Under a FWA network, voice and broadband data is delivered to transmission towers (ground stations) via fibre connections and radio signals are used to access the end-user. The receiver can be a mobile device (such as a smartphone), or a dedicated transceiver (an antenna) installed on the customer's premises to receive the signal and deliver it to a modem.

FWA tends to offer broadband speeds that are lower than copper/FTTN or FTTH. Theoretically, it can deliver up to 1Gbps, however such speed is generally unachievable.

[99] ERG - Recommendation on how to implement the commission recommendation C(2005) 3480 - 2005

[100] ComReg Decision D01/10.

[101] See Annex, section 11.1.2.

Broadband speeds advertised by operators are 21 Mbps (3G) to 25 Mbps (4G) downstream and 5 Mbps upstream. Moreover the speed decreases significantly with the distance. In addition, the quality of FWA service is adversely affected by obstacles such as hills, trees, walls or even rain and fog, contrary to wired networks.

As a consequence, FWA cannot be considered as the MEA in the specific context of Ireland.

Analysis of FTTC/FTTH as the MEA

Depending on national circumstances, an FTTH, an FTTC or a mixed network may be considered as a modern efficient NGA network:

> *"In the light of the principle of technological neutrality and in view of different national circumstances, NRAs need a degree of flexibility to model such a modern efficient NGA network." "An FttH network, an FttC network or a combination of both can be considered a modern efficient NGA network."*[102]

The technology that will be most widely used in Ireland is FTTC, which is why it is appropriate to model the network based on this technology. At the same time, it should not be forgotten that Vodafone is going to deploy FTTH in some areas.

However, since LLU, SLU, Line Sharing, SB-WLR and Naked DSL are entirely based on the copper network, the result should be adjusted by replacing the optical elements with copper elements.

> *"When determining the access prices of services that are entirely based on copper, NRAs should adjust the cost calculated for the modeled NGA network to reflect the different features of wholesale access services that are based entirely on copper. For this purpose, the NRAs should estimate the cost difference between an access product based on for example FttC/FttH and* ***an access product based entirely on copper*** *by replacing the optical elements with efficiently priced copper elements, where appropriate, in the NGA engineering model."*

To conclude, it is recommended to build the BU-LRAIC+ model based on FTTC technology and adjust it by replacing the fibre elements with copper elements:

- **Calculating the cost of a full copper network ensures that the current costs of Eir is calculated.**
- **Calculating the cost of a FTTC network ensures that the model is future-proof for pricing purposes.**

[102] European Commission, Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, C(2013) 5761

It is important to understand that modelling an NGA network and adjusting the cost to reflect the different features of wholesale access services that are based entirely on copper by estimating cost differences is equivalent to modelling an entire copper access network. Indeed, a FTTH or FTTC network will include trenches, poles, fibre cables, optical joints, copper cables (for FTTC), etc. Adjusting all these assets to reflect copper costs (i.e. increasing slightly the size of trenches because copper cables require more space, replacing fibre cables by copper cables, optical joints by copper joints, etc.) means in reality modelling a copper network. This is the approach followed by DBA in Denmark[103] and by HAKOM in Croatia[104].

8.5.3.2 Active assets of the SB-WLR product

For the SB-WLR products, the technology used can either be PSTN or IP. Based on ComReg's decision on mobile and fixed voice call termination rates in Ireland (D12/12, 21 November 2012), it is reasonable to assume that the network should be based on an NGN core network with IP switching technology at the switching layer.

8.5.3.3 Active assets of the Naked DSL product

For Naked DSL products, the modelled network can either be the legacy network or the Next Generation network (NGN). In Ireland, as NGN is already largely deployed, this should be the technology that should be modelled.

8.5.4 Wholesale specific costs (e.g. carrier administration and billing costs)

Wholesale specific costs must not distort the build or buy signals in case of a significant difference in final unit cost. A brief example will help to explain this point. Let us assume that:

- the specific cost of deploying the LS service is 100k€ which will bring 100'000 customers;
- whereas the specific cost of deploying SLU is also 100k€ but will bring 10'000 customers;
- then the wholesale specific unit cost of SLU will be much higher than the wholesale specific unit cost of LS, which may distort the build or buy signal.

[103] http://erhvervsstyrelsen.dk/file/348279/udkasttilanalyse.pdf

[104] Commission Decision concerning Case HR/2014/1560, 5.3.2014

9 Assessing the Impact of the Preferred Approach

A regulatory impact assessment analyses the expected effect of proposed regulation in order to ensure that it is likely to give the desired result.

9.1 Impact assessment on implementing geographic de-averaging or setting a national price

The three regulatory options, Option 0, Option 1 and Option 2, are summarized in the table below.

TERA Consultants has studied the impacts of the three proposed policy options on different stakeholders: Eir, alternative operators and consumers. These are already discussed in the section 6.3.2 and are summarized below.

The proposed policy helps to encourage competition. Service-based competition will develop in non-LEA areas. Both service-based and infrastructure-based competition will develop in LEA areas.

NGA investment is encouraged in the LEA[105]. Indeed, since the correct build-or-buy signals will be sent in the LEA, operators will invest in the NGA network whenever it is efficient to do so. Outside the LEA, an NGA network is unlikely to develop in the short term (absent public initiative).

[105] In case it appears that investment in wired access network infrastructure from private operators is likely in some areas outside LEA and needs to be incentivised, then it will be necessary to include these areas. However, it does not seem likely today and Vodafone/ESB plans are not sufficiently clear until now to understand whether this new investment will occur outside LEA. This is why the term “LEA” is used here.

Table 19. Impact assessment of geographic de-averaging vs national price

Regulatory option	Impact on incumbent	Impact on alternative operators	Impact on consumer
Option 0: nationally averaged price based on the whole territory (with civil engineering which can be re-used for NGA based on top-down and other assets on bottom-up)	Eir may benefit from a cost over-recovery as the wholesale prices will be based on the whole territory whereas the WPNIA will be most likely bought in the LEA.	WPNIA (and WBA) prices will be high, which will distort competition and prevent the development of new entrants. Alternative operators may however benefit from higher prices from Eir to improve their own network deployment profitability, as long as these deployments do not require accessing Eir's reusable civil engineering assets.	Option 0 is clearly detrimental to consumers, as the absence of competitive prices on the wholesale market will reduce any competitive pressure on the retail market: consumers will experience higher retail prices. It is not clear that these prices would reduce when alternative infrastructure would develop (if they develop) because each access network will experience lower economies of scale compared to a monopoly situation.
Option 1: nationally de-averaged price with civil engineering in top-down and other assets either in bottom-up or in top-down depending on the geographic area	The investment incurred by Eir in the past is exactly recovered through price de-averaging. Consequently, Eir's incentives to invest in the legacy network maintenance are provided. Eir is encouraged to deploy the NGA network in the LEA	In the LEA, a right build-or-buy signal is sent, so that alternative operators can efficiently invest. Alternative infrastructure providers present in the LEA (in particular UPC and the ESB/Vodafone joint venture) are able to compete with the services based on the legacy network under the condition that it is at least as efficient.	Consumers are positively influenced through the development of competition and through the deployment of new investments. Consumers benefit from a lower price thanks to the service-based competition outside the LEA and both service-based and infrastructure-based competition in the LEA. However, compared to Option 2, the service-based competition outside the LEA develops to a lesser extent. Consumers also benefit from efficient investments in new infrastructure in the LEA.

Regulatory option	Impact on incumbent	Impact on alternative operators	Impact on consumer
Option 2: nationally averaged price based on the LEA with civil engineering in top-down and other assets in bottom-up but Eir's actual top-down costs are considered for products also sold outside LEA	Eir's investment incentives are maintained. By considering in addition Eir's national actual costs for products sold nationally (such as SB-WLR or Naked DSL), Eir is ensured to recover its costs	The result is similar to Option 1. Access price in non-LEA is lower compared to Option 1 which makes access service-based market entry more effective.	The result is similar to Option 1. Since there is no difference in access price between the LEA and outside the LEA, the risk of digital divide is minimised compared to Option 1.

Option 0 should be dismissed as it is clearly detrimental to end-users by increasing for a long period of time retail prices.

Option 1 should be preferred by ComReg if it decides that the geographically de-averaged price is acceptable. It should be highlighted that geographic de-averaging already exists *de facto* because of wholesale price reductions made by Eir in selected competitive areas. However, using a top-down HCA-FAC approach for non-civil engineering assets may appear inconsistent with the European Commission's September 2013 recommendations.

Since **Option 2** sets a nationally averaged price, it should be preferred by ComReg if it wants to minimise the risk of digital divide. Using a bottom-up model for non-civil engineering assets is consistent with the European Commission's recommendation. However, by allowing Eir to recover its actual top-down costs for products sold also outside LEA (SB-WLR, Naked DSL), Eir is ensured to recover its costs. For wholesale products mainly sold inside LEA (LLU), this approach ensures that incentives to invest are protected as it is unlikely that any investment (except with subsidies) will occur outside LEA[106].

[106] It may happen that Eircom launch NGA services Outside current LEA but NGA will be provided to users close to the exchange and not at the cabinet which means that the cost of these lines serve by NGA would probably not differ from LEA areas.

9.2 Impact assessment on implementing a cost orientation approach on Market 4

The retail minus approach is broadly used for services that include renting active equipment from the SMP operator and so require less investment from alternative operators. Such services are “closer” to retail services.

Consequently, for SB-WLR both pricing approaches are applicable, and there is a need to define the most efficient one.

As explained in 3.3, ComReg’s objectives in the context of access pricing include competition, investment and end user interests.

9.2.1 Arguments in favour of retail-minus

On the one hand, two arguments are in favour of a retail-minus approach:

1. First, since SB-WLR is currently priced on a retail-minus approach, choosing this approach would provide regulatory consistency. Regulatory consistency is important since it provides operators with a long-term vision and so facilitates planning investments.
2. Second, an advantage of the retail minus approach is its ease of implementation: there is no need to build a cost model. In addition, more data is needed to construct a cost model than to set access prices based on retail minus approach. However, in our case it does not apply since the model will be built in any case for Market 4 (WPNIA) services, it will only be necessary to extend it to calculate costs of SB-WLR and Naked DSL. All the necessary data will be collected for the purpose of Market 4 (WPNIA) costing. Also, ComReg has already developed a WBA cost model.

9.2.2 Arguments in favour of cost orientation

On the other hand, five arguments are in favour of a cost orientation approach:

1. First, using the same pricing approach (cost orientation) for all the services (LLU, SLU, Line sharing, SB-WLR and Naked DSL) provides more consistency across the investment ladder. Potential discrepancies could favour, for example, the use of Naked DSL against LLU or SLU, and so would prevent an alternative operator from climbing the investment ladder. For example, if the retail naked DSL price is equal to 20 and LLU price is equal to 10 and that the retail minus approach leads to wholesale naked DSL price to 15, by decreasing retail naked DSL to 15, the SMP operator could foreclose LLU operators (and then could later increase retail prices). This argument is less relevant in rural areas where LLU is unlikely. However, in rural areas, Eir could set excessive retail and therefore wholesale prices.
2. Second, by definition the strict recovery objective is better ensured when the cost orientation approach is chosen.

3 Third, the chosen approach should ensure that the access price is not too high, so that competition may develop and a correct build-or-buy signal is sent. This condition holds automatically for cost orientation, while under retail minus the access price may be too high if the retail price is high. This can occur in areas where no competition from alternative infrastructure providers is present. In Ireland it is relevant outside the LEA. However, in areas where competition at the retail level is sufficient, a retail minus approach can suffice.

4 Fourth, the chosen pricing method should ensure predictability of access price levels for alternative operators. Otherwise they cannot invest. Cost orientation better meets this criterion because the retail-minus methodology links wholesale prices and retail prices and the latter can vary often.

5 For legacy bitstream services, ComReg has recently moved to a cost orientation obligation, especially to avoid excessive prices in rural areas.

6 Cost orientation has been imposed by ComReg for Naked DSL Outside the LEA.

Table 20. Comparing cost orientation and retail minus approach applied to SB-WLR and Naked DSL

Criterion	Cost orientation	Retail minus
Maintaining price stability / Regulatory continuity	✓ (for Naked DSL)	✓ (for SB-WLR)
Consistency across investment ladder	✓	×
Avoiding cost over-recovery	✓	×
Avoiding cost under-recovery	✓	×
Sending a correct build-or-buy signal	✓	×

Source: TERA Consultants

9.2.3 Conclusion

On Market 4 (WPNIA), cost orientation is the most used methodology in Europe and has been the methodology used by ComReg until now. Indeed, full LLU, Line Share and SLU are essential inputs for OAOs and for their investors as they represent a key element to build business cases.

If a retail-minus approach is used for these products, it will not provide stability to investors since any movement at the retail level will be transposed at the wholesale level. Also, it may provide too high a margin to Eir for such products.

In contrast, cost orientation enables the prices of these products to be set based on the underlying costs and therefore facilitates OAOs and investors to make relevant choices

(build or buy choices). Also, this methodology avoids over-recovery and under-recovery of costs by Eir. Finally it provides more stability to stakeholders.

Therefore, the **cost orientation** approach applied to WPNIA products is better aligned with ComReg's objectives.

Table 21. Impact assessment of retail minus vs cost orientation

Regulatory option	Impact on incumbent	Impact on alternative operators	Impact on consumer
Retail minus	May lead to over-recovery	Uncertainty if retail prices move Risk of influencing the choice of OAOs towards one wholesale offer or another compared to a cost orientation	May lead to higher retail prices in the long run
Cost orientation	Strict cost recovery	Certainty	Benefit from competition between the incumbent and OAOs

Source: TERA Consultants

9.3 Impact assessment on allowing Eir to lower prices below the cost-oriented level set by Comreg

This section presents solely TERA Consultants economic point of view and does not provide any legal view on the possibility for Eir to lower prices.

A first possibility for ComReg is to set the wholesale price as being strictly equal to the regulated level ComReg has established. In other words, Eir would not be allowed to decrease wholesale prices below the regulated level. This provides strong regulatory certainty for OAOs, but is detrimental to Eir who cannot compete with OAOs and ultimately to consumers, especially if alternative access networks propose much lower prices.

Another possibility is a "regulatory approval" mechanism: when Eir asks ComReg to decrease wholesale copper access prices in a given geographic area, Eir must use a margin squeeze test to justify that, without such a reduction, the alternative operator's retail price is non-replicable.

This mechanism helps alternative operators to plan their investment. If Eir's access price decreases, it is done only following a retail price decrease from one of the alternative operators. This makes access prices predictable for alternative operators.

Under the proposed mechanism, Eir will have to decrease the prices of all the relevant wholesale services at the same time to ensure consistency across the ladder of

investment. ComReg will also ensure that Eir does not decrease its wholesale price below a "price floor", based for example on its local HCA costs.

Such a mechanism will avoid situations where Eir introduces temporary price discounts in a given geographic area in order to foreclose a competitor from the market or in order to encourage bitstream services at the expense of WPNIA services.

A third and last option is based on not doing anything, i.e. let Eir do what it wishes with its copper access prices (as long as they are below the regulated level). This would mean that potential issues would be solved *ex post*. This would provide uncertainty, especially as *ex post* procedures can take considerable time.

Table 22. Impact assessment of "No possibility for Eir to lower prices" vs "Regulatory mechanism" vs Price floor vs "Do nothing"

Regulatory option	Impact on incumbent	Impact on alternative operators	Impact on consumer
No possibility for Eir to lower price	Incumbent cannot compete with other alternative operators	Risk of inefficiencies	Risk of higher retail prices due to lack of competitive pressure
"Regulatory approval" mechanism	No temporary price discount	Can plan their investments (predictability)	Benefit from competition between the incumbent and OAOs
Do nothing	More flexibility but uncertainty	Significant uncertainty	No direct impact

Source: TERA Consultants

The "regulatory approval" mechanism is the preferred option as it provides more certainty to stakeholders and is pro-competitive. However, this is an additional constraint on the incumbent.

10 Glossary of Terms

AIP	Alternative Infrastructure Provider
BEREC	Body of European Regulators of Electronic Communications
BU	Bottom-Up
CCA	Current Cost Accounting
DSL	Digital Subscriber Line
EC	European Commission
ERG	European Regulatory Group
FAC	Fully Allocated Cost
FAR	Fixed Asset Register
FCM	Financial Capital Maintenance
FTTB	Fibre To The Building
FTTC	Fibre To The Cabinet
FTTH	Fibre To The Home
FTTN	Fibre To The Node
FWA	Fixed Wireless Access
HCA	Historical Cost Accounting
LEA	Large Exchange Areas
LFI	Line Fault Index
LLU	Local Loop Unbundling
LRIC	Long Run Incremental Cost
LS	Line Sharing
MEA	Modern Equivalent Asset
NBP	National Broadband Plan
NBV	Net Book Value
NGA	Next Generation Access
NGN	Next Generation Network
NRA	National Regulatory Authority
OAO	Other Authorised Operator
OCM	Operating Capital Maintenance

PSTN	Public Switched Telephone Network
SABB	Stand-Alone BroadBand
SB-WLR	Single Bill Wholesale Line Rental
SLU	Sub Loop Unbundling
TD	Top-Down
VDSL	Very high bit-rate Digital Subscriber Line
VUA	Virtual Unbundling Access
WBA	Wholesale Broadband Access
WPNIA	Wholesale Physical Network Infrastructure Access

11 Annex

11.1 European Regulatory Framework

As indicated in section 3.2, this annex describes guidance formulated at the European level and which are relevant to this report:

1 The Judgment of the CJEU in C-55/06 Arcor AG & Co. KG v Bundesrepublik Deutscheland [2008] ECR I-2931 (as appropriate);

2 The European Commission recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA) *(2010/572/EU) (OJ L 251/35);*

3 The European Commission recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment (C(2013)5671 final);

4 Comment letters issued by the European Commission to other Member States under Article 7 (A) of the Framework Directive.

11.1.1 The Judgment of the European Court of Justice in the Arcor Case

NB*:* this case was decided in the context of a different regulatory regime i.e. the scope of Regulation 2887/2000 but the conclusions, especially those of the Advocate General, remain interesting.

The Judgment of the European Court of Justice of the 24th of April 2008[107] in relation to the Arcor Case was already considered by ComReg in its Decision D01/10 on LLU and SLU pricing.

Arcor AG & Co, a German competitor company had sought LLU from the German fixed line incumbent (Deutsche Telekom) and had made the preliminary reference in the context of alleging that the prices set by Deutsche Telekom for access to LLU (and approved by the federal regulatory agency in Germany) were too high. On 24 April, 2008, the ECJ delivered its final ruling. The Advocate General's opinion outlining suggested responses to the questions posed by the German court and the final ruling provide legal guidance on the setting of cost oriented prices for LLU. In particular, the suggested answers to the questions provide explanations about asset valuation methodologies that

[107] Arcor AG & Co. KG v Federal Republic of Germany [Case C-55/06]

can be used and about the possibility of using analytical cost models for setting of LLU prices.

While ECJ concludes that NRAs have a broad discretion concerning the calculation basis, the Advocate General provides interesting analyses.

The Advocate General considers two alternative methods to calculate costs: the current costs of replacement (similar to BU-LRIC in terms of the present report) and the costs inherent in the construction of this alternative operator (similar to TD in terms of the present report). The Advocate General recognises that these two methods do not give the same results:

> *"…setting charges for access to the existing local loop on the basis of the current cost of replacement with a new and equivalent local network does not necessarily reflect the costs inherent in the construction of this alternative infrastructure".*

The Advocate General considered that the use of replacement costs is possible if a new technology is available and there is a need to encourage investments in this technology:

> *"…there are two possible justifications which could be put forward. Firstly, (…) it is possible that the advanced age of the network could justify using a method based on gross replacement costs. Secondly(…), it is possible that (…), investment in alternative technologies available at the time, with functionality equivalent to Deutsche Telekom's local copper wire network, would have been significantly discouraged if the charges had been set below the figure obtained using a calculation method based on the gross cost of replacing the network.(…) If neither of these two justifications applies, the conclusion must be that it would be contrary to the concept of cost-orientation to use as the exclusive basis for calculating costs the current replacement value of the assets, expressed in terms of current daily prices at the time of valuation."*

The Advocate General explains that the choice between the top-down and the bottom-up method should be made depending on the NRA's priorities of long-term or short-term competition development:

> *"where incentives to invest in alternative infrastructure justifiably take precedence over the aim of fostering short-term competition on the local loop access market, giving priority to the cost of investment in a new, modern and efficient network at the expense of the notified operator's actual capital costs should be regarded as compatible with the principle of rates set on the basis of cost-orientation".*

11.1.2 European Commission Recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies

to promote competition and enhance the broadband investment environment

The main recent development in Europe on the subject of the copper access pricing is the European Commission recommendation on non-discrimination and costing methodologies published on the 11th of September 2013[108].

This recommendation addresses several subjects such as the case where the cost orientation obligation could be relaxed for NGA wholesale products, the economic replicability test and the equivalence of inputs/outputs issue but the subject relevant here is the cost orientation obligation applied to legacy services.

The European Commission distinguishes between reusable and non-reusable civil engineering assets and defines them as follows:

> *"'Non-reusable civil engineering assets' are those legacy civil engineering assets that are used for the copper network but cannot be reused to accommodate an NGA network."*
>
> *"'Reusable civil engineering assets' are those legacy civil engineering assets that are used for the copper network and can be reused to accommodate an NGA network."*[109]

The recommendation explains that the calculation of copper and NGA wholesale access prices should be based on a replacement cost based on the BU LRIC + approach except for civil engineering costs deployed for legacy services which can be reused for NGA services. The bottom-up model should be based on an NGA network even for copper-based access services since NGA is the modern equivalent asset for copper.

> *"NRAs should adopt a BU LRIC+ costing methodology that estimates the current cost that a hypothetical efficient operator would incur to build a modern efficient network, which is an NGA network."* (§31)
>
> "*When modelling an NGA network, NRAs should include any existing civil engineering assets that are generally also capable of hosting an NGA network as well as civil engineering assets that will have to be newly constructed to host an NGA network. Therefore, when building the BU LRIC+ model, NRAs should not assume the construction of an entirely new civil infrastructure network for deploying an NGA network."* (§32)
>
> *"NRAs should value all assets constituting the RAB (Regulatory Asset Base) of the modelled network on the basis of replacement costs, except for reusable legacy civil engineering assets.* (§33)"

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[108] European Commission, Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, C(2013) 5761

[109] European Commission. Commission staff working document. Impact assessment. Accompanying the document Commission recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, SWD(2013) 329 final, 11 September 2013

In order to respect the technological neutrality principle, the European Commission does not give a more precise definition of an NGA network. Depending on national circumstances, an FTTH, an FTTC or a mixed network may be considered as a modern efficient NGA network:

> *"In the light of the principle of technological neutrality and in view of different national circumstances, NRAs need a degree of flexibility to model such a modern efficient NGA network." "An FttH network, an FttC network or a combination of both can be considered a modern efficient NGA network."*[110]

For copper-based services the NGA cost should be adjusted by replacing the optical elements by copper elements.

> *"When determining the access prices of services that are entirely based on copper, NRAs should adjust the cost calculated for the modeled NGA network to reflect the different features of wholesale access services that are based entirely on copper. For this purpose, the NRAs should estimate the cost difference between an access product based on for example FttC/FttH and an access product based entirely on copper by replacing the optical elements with efficiently priced copper elements, where appropriate, in the NGA engineering model."*

Reusable civil engineering assets should be priced based on SMP operator's accounts, deducting depreciation and using a price index. This method ensures that operators are not recovering more than what they invested in the past (if properly applied, i.e. if the net value is properly calculated).

> *NRAs should value reusable legacy civil engineering assets and their corresponding RAB on the basis of the indexation method. Specifically, NRAs should set the RAB for this type of assets at the regulatory accounting value net of the accumulated depreciation at the time of calculation, indexed by an appropriate price index, such as the retail price index. (…) NRAs should not include reusable legacy civil engineering assets that are fully depreciated but still in use.* (§34)

To conclude, the European Commission recommends the calculation of copper wholesale access prices based on a replacement cost using a BU LRIC + approach except for reusable civil engineering costs that should be calculated from the accounting value. The bottom-up model should reconstruct an NGA network but adjusted for copper technology characteristics. Reusable civil engineering assets should be priced based on SMP operator's accounts, deducting depreciation and using a price index.

11.1.3 European Commission Recommendation of 20 September 2010 on Regulated Access to NGA

On 20 September 2010, the European Commission published a recommendation on the regulated access to NGA. This recommendation mainly discusses NGA access which is

[110] European Commission, Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, C(2013) 5761

therefore not directly relevant here. However, it provides guidelines for duct access pricing and costing: it is recommended to set cost-oriented prices ensuring a reasonable return on capital.

> *"Cost-oriented prices imply a reasonable return on capital employed. When investments in non-replicable physical assets such as civil engineering infrastructure are not specific to the deployment of NGA networks (and do not entail a similar level of systematic risk), their risk profile should not be considered to be different from that of existing copper infrastructure."*[111]

11.1.4 European Commission's Comments on National Regulatory Authorities Notifications on Costing and Pricing Methodologies for the Local Loop

Several National Regulatory Authorities (NRA) have sent notifications to the European Commission in relation to costing/pricing methodologies for the copper local loop.

Some of these proposed decisions have been challenged by the European Commission. The German, Austrian and Estonian decisions are of particular interest. The case of Italy is also interesting since it is one of the first times that the European Commission has looked at the detailed parameters.

The main comments from the European Commission are summarised below. It is noted that for the Estonian Case the BEREC agreed with the European Commission and gave its advice recently in the document "BEREC Opinion on Phase II investigation pursuant to Article 7a of Directive 2002/21/EC as amended by Directive 2009/140/EC: Cases EE/2013/1453-1454".

[111] §14, European Commission, Commission recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA), 2010/572/EU

Table 23 – Recent NRA notifications and EC comments in relation to local loop costing/pricing methodologies

Country	Date	Methodology	NRA Justification	EC observations
Denmark	8 April 2014	BU-LRAIC approach	Mimics the level of costs in a competitive and contestable market	No comments
Croatia	5 March 2014	BU-LRAIC approach except for civil engineering costs which are based on top-down CCA costs	Costs are calculated on exchanges likely to be unbundled	Need for additional justification for the assumptions made in relation to the length of the sub-loops in the cost model
Romania	14 February 2014	Bottom-up LRAIC CCA approach	N/A	No comments
Belgium	15 November 2013	Price control	N/A	No comments
Netherlands	8 November 2013	Top-down approach	N/A	Need for cost oriented MDF pair bonding prices Need for consistency in price regulation in the transition to NGA networks in the Netherlands and across the EU, to enhance the broadband investment environment
Portugal	13 September 2013	Cost orientation	N/A	No comments
Germany	13 March 2014	BU-LRAIC approach	Efficient service provision	Legal certainty and promotion of efficient NGA investment
Italy	12 August 2013	BU-LRAIC approach	N/A	Serious doubts on the WACC parameter Serious doubt on the cost review process SLU price (set at 2/3 of LLU) and risk premium for WBA are not justified
Latvia	12 August 2013	FDC CCA approach but SPRK explains that a new model will be developed	N/A	Should notify exact cost model containing price levels for Markets 4 and 5
Germany	24 June 2013	BU LRIC for all assets	To facilitate NGA investment	Should reconsider volume effects Should review methodology for ducts

Country	Date	Methodology	NRA Justification	EC observations
Austria	25 July 2013	Minimum of BU LRIC and margin squeeze test	N/A	Do not send appropriate make or buy signals Too intense price competition deter NGA investment BU LRIC models wrongly take volume effects into account, wrongly value ducts and OPEX are calculated on mark-up basis
Spain	27 June 2013	Mix of BU-LRIC+, HCA and benchmark	BU-LRIC model is new and gives too high prices	Should be reviewed
Estonia	13 June 2013	HCA	Low price and easier to implement	Do not send appropriate make or buy signals Too intense price competition deter NGA investment
Italy	21 October 2010	BU-LRIC with HCA for some assets	N/A	Can send wrong investment signals

Source: TERA Consultants

The following can be concluded:

- BU-LRIC approach is widely used by NRAs and is generally approved by the European Commission,
- From the European Commission's point of view, it is important to justify that the access price sends a correct build-or-buy signal where relevant.

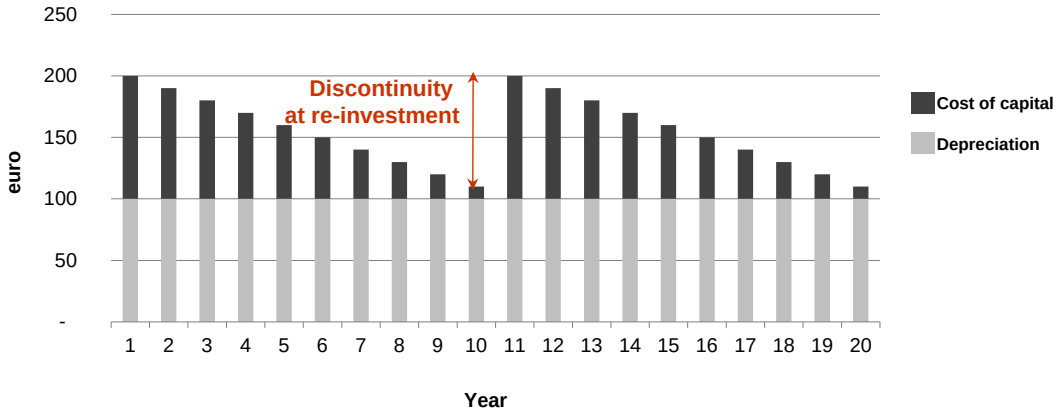
11.2 Depreciation methods

11.2.1 Straight line or linear depreciation (HCA, Historic Cost Accounting)

This is the most widespread method used in accounting. Depreciation charges are simply derived by dividing the investment by the asset life.

The issue with this approach is that, when the return on capital employed is included to derive annuities, these annuities do not evolve in a smooth way: the annuity is very sensitive to investment cycles (see figure below).

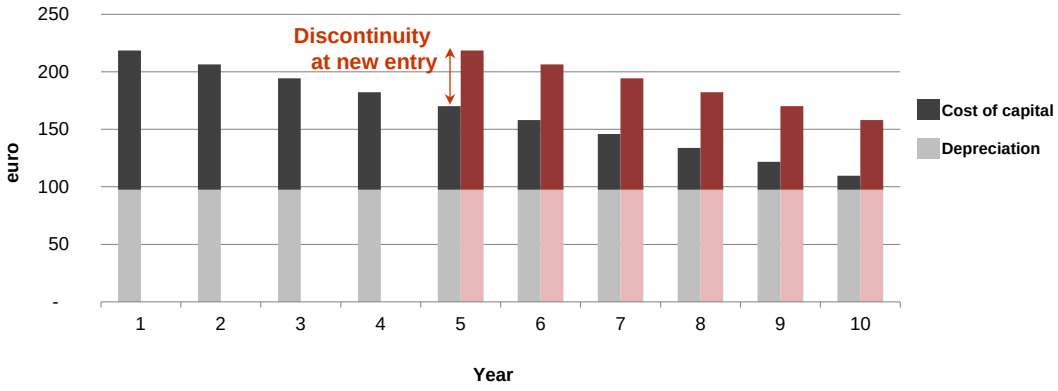
Figure 13: Impact of re-investment on HCA annuities



Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%
Source: TERA Consultants

In particular, the annuity faced by a new entrant would be much higher than the annuity faced by the incumbent (see figure below). If access price is based on this annuity, a new entrant always prefers to buy access services instead of investing in its own infrastructure, which is inefficient. A wrong build-or-buy signal is sent. The issue is exacerbated when asset prices evolve over time, which is often the case in electronic communications.

Figure 14: Competitor entry after 5 years under HCA depreciation



Grey: incumbent, red: new entrant
Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%
Source: TERA Consultants

11.2.2 The CCA-OCM method

This method captures changes in asset prices, which is why it is called a current cost accounting depreciation method.

This method has a serious drawback. Contrary to the HCA method, the CCA-OCM method does not ensure that costs are exactly recovered, i.e. the sum of discounted annuities is not equal to the initial investment. Therefore, if the access price is based on this method, the access to an infrastructure is not cost oriented (except under very specific circumstances). This is the reason why this method is not appropriate for calculation of depreciation for regulation purposes.

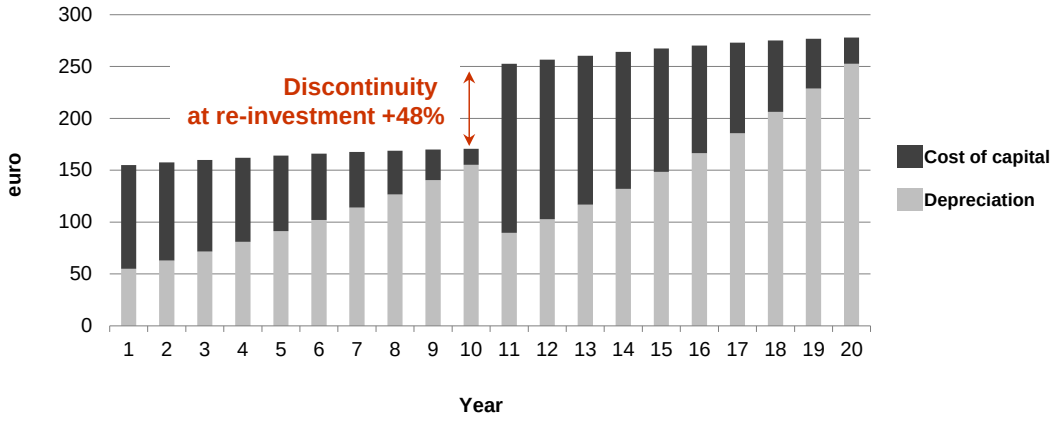
11.2.3 The CCA-FCM method

Similar to the CCA-OCM, the CCA-FCM method takes into account changes in asset prices. However, contrary to the CCA-OCM method, the CCA-FCM method ensures that costs are exactly recovered. This is why this method is often preferred by national regulators[112].

However, as is the case with HCA, the method does not exactly ensure that the annuities faced by an operator are evolving smoothly where the prices of the asset are changing. This is illustrated in the figure below, which shows that when the asset needs to be renewed (at the end of year 10 in the example shown), CCA-FCM generates a discontinuity.

[112] ERG Guidelines on Accounting Separation & Cost Accounting Systems (2005): "*For the reporting of top-down regulatory accounts, the FCM concept might be preferred because it could better address the concerns of shareholders and potential investors.*"

Figure 15: Asset renewal at a higher price under CCA-FCM depreciation



Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%, price trend = +5% per year.
Source: TERA Consultants

Neither linear depreciation, nor CCA-OCM, nor CCA-FCM can ensure a smooth transition when the asset is replaced. Furthermore, these methods calculate annuities that can lead to significant cost differences for operators investing in the same asset but at a different point in time. They therefore tend to distort economic signals.

11.2.4 Standard Annuity

Contrary to HCA and CCA depreciations, standard annuity, tilted annuity and adjusted tilted annuity can ensure that two entrants buying the same assets but at different point in time will bear similar annuities. This feature is important for regulation purposes. As a consequence, such depreciation is in theory capable of sending perfect "build-or-buy" signals. Standard annuity, tilted annuity and adjusted tilted annuity also provide for the exact recovery of the initial investment.

The standard annuity approach consists in calculating an annuity *A*, which is identical every year and which respects the following equation:

$$I = \frac{A}{(1+w)} + \frac{A}{(1+w)^2} + \cdots + \frac{A}{(1+w)^n}$$

Then, *A* can be written as follows:

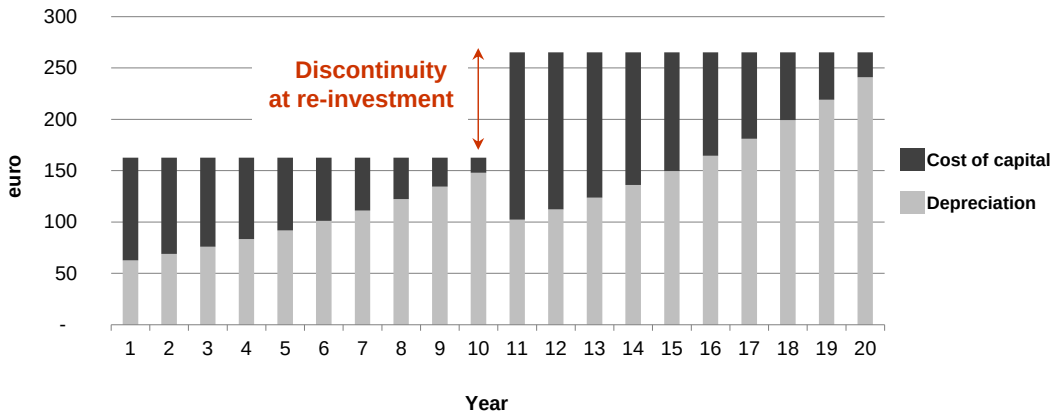
$$A = I \times \frac{w}{1 - \left(\frac{1}{1+w}\right)^n}$$

where ω is the cost of capital, *I* the investment and *n* the asset life.

The standard annuity approach calculates an increasing depreciation charge and a decreasing return on capital employed in such a way that the annuity remains stable over time.

The standard annuity formula is used by banks to calculate the monthly payment related to a mortgage. Because standard annuities (sometimes called flat annuities) do not take into account changes in the asset price, they do not reflect the market evolution of the asset value and therefore cannot be considered as appropriate economic depreciation for regulation purposes in electronic communications sector. They are rarely used in bottom-up models. Like HCA depreciation, such annuities can create distortions and discontinuities in regulated price evolution when asset prices change over time.

Figure 16: Asset renewal at a higher price under standard annuity method

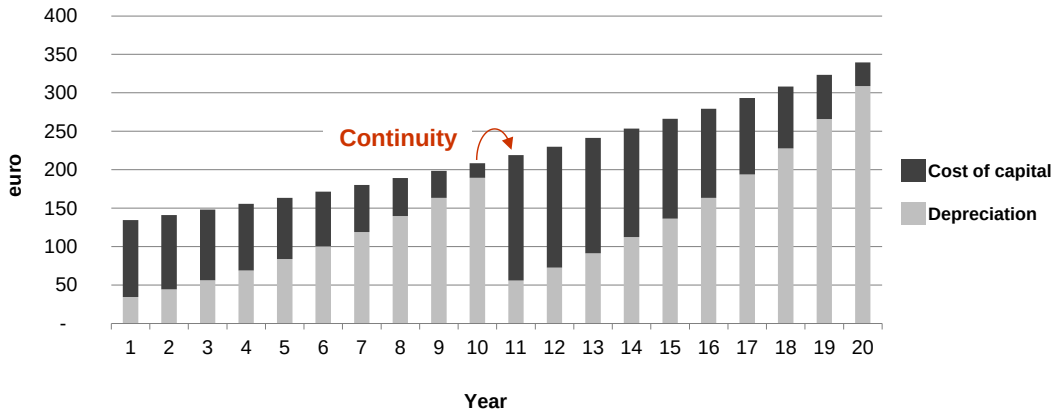


Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%, price trend = +5% per year.
Source: TERA Consultants

11.2.5 Tilted annuity

The tilted annuity formula is probably the most widespread one used for regulatory purposes. It incorporates a tilt in its formula which facilitates the calculation of annuities that evolve in line with asset price changes (this is therefore a current cost approach): if an asset price increases by say 5% per annum, annuities will also increase by 5% per annum, as illustrated in the figure below. Such a formula sends appropriate 'build-or-buy' signals to market players. It also allows NRAs to replicate the annual charges that would be faced by an operator in a competitive market.

Figure 17: Asset renewal at a higher price under tilted annuity method



Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%, price trend = +5% per year.
Source: TERA Consultants

A tilted annuity can be calculated on the basis of the following formula:

$$I = \frac{A_1}{(1+\omega)} + \frac{A_1 \times (1+p)}{(1+\omega)^2} + \ldots + \frac{A_1 \times (1+p)^{n-1}}{(1+\omega)^n}$$

which can be written as follows:

$$A_t = I \times \frac{(\omega - p)(1+p)^{t-1}}{1 - \left(\frac{1+p}{1+\omega}\right)^n}$$

Where ω is the cost of capital, I the investment, t the year considered, n the asset life, p the tilt (price trend of the asset in the long term) and A_t the annuity of year t[113]. This formula is derived by the same equation as standard annuity, but with the following relationship between each annuity:

$$A_t = A_{t-1} \times (1+p)$$

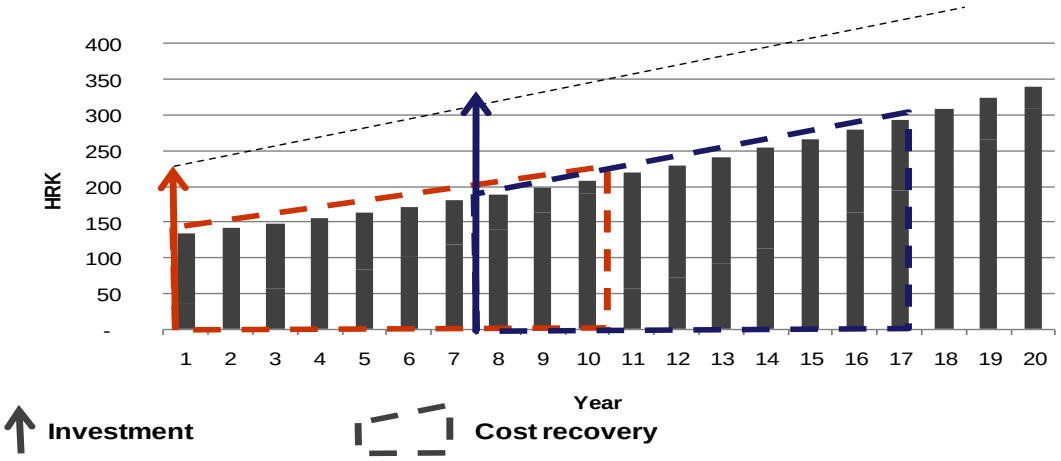
which means that annuities are evolving with asset prices.

[113] This annuity is calculated by assuming that the first annual cost recovery is happening one year after the investment is made. If the time between the moment the first annuity happens and the investment is paid is one year lower (respectively one year higher), then the annuity should be multiplied by a $(1+\omega)^{-1}$ (respectively $(1+\omega)$).

As a result, tilted annuities provide for a smooth evolution of annual cost despite price changes and despite investment cycles. Indeed, at the end of the useful life of an asset, i.e. when the asset needs to be renewed, the annuities calculated with the tilted annuity method will be similar just before and just after the renewal of the asset (as shown on the figure above). Therefore, annuities evolve without the discontinuities which are one of the main drawbacks of the HCA, CCA-OCM and CCA-FCM approaches.

A theoretical example will illustrate this advantage. An operator buys an asset in year 1 with a lifetime of 10 years. The annuity calculated with the tilted annuity method at any given year (during the lifetime of the asset) can be the annuity of a given asset *whatever the moment it was bought during the past*. The figure below illustrates the situation where the asset is bought in year 1 and the same asset is bought in year 8. It can be seen that the annuities for both assets are the same during the lifetime of each asset.

Figure 18: Annuities with the tilted annuity method for two same assets bought at year 1 and year 8.



Numerical example: an asset with price equal to 1000, with lifetime equal to 10, WACC=10%, price trend = +5% per year.
Source: TERA Consultants

If the volume of output produced by an asset is stable, then the tilted annuity is a good approximation for economic depreciation. For example, the Norwegian NRA and the Danish NRA have both published a report saying that in "*a fixed network, circuit-switched traffic levels are generally stable, and so tilted annuities are often chosen as a proxy for economic depreciation*[114]*.*"

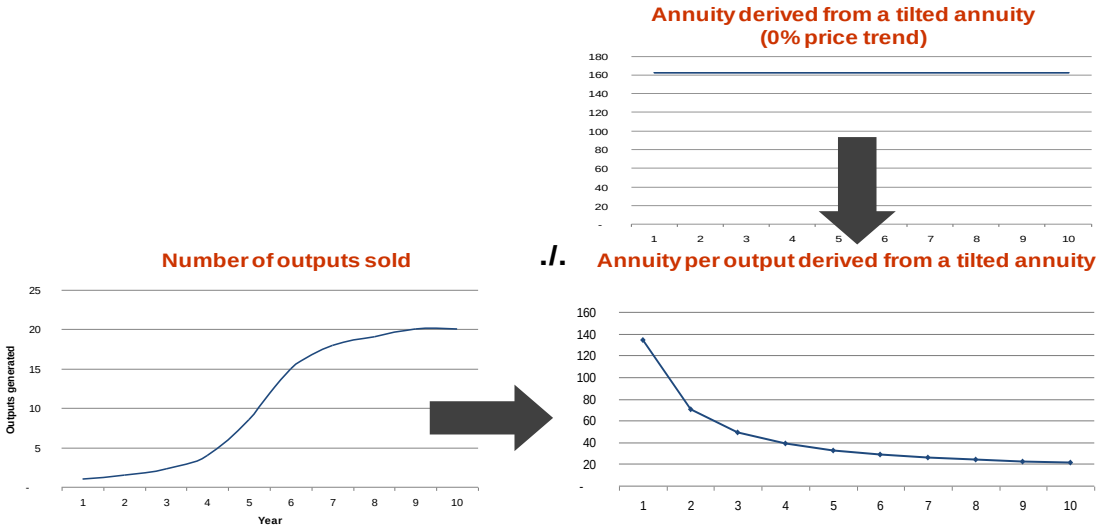
However, the tilted annuity may not be a good proxy for economic depreciation when the volume of outputs produced by an asset is not stable[115]. This may be the case for new

[114] NPT, Conceptual approach for a LRIC model for wholesale mobile voice call termination Consultation paper for the Norwegian mobile telecoms industry 27 February 2006 and Analysys, LRAIC model of mobile termination: specification consultation paper for industry, 2007

[115] See ITST, Report on the LRAIC Model and User Guide Revised Hybrid Model (version 2.5.2), June 2009. See pages 33 and 34 for discussions on standard, tilted annuities and economic depreciation

products (which have a logistic curve) or when demand is evolving fast (see example below).

Figure 19: Example of unit cost derived on the basis of the tilted annuity formula when the number of output produced by an asset is increasing



In this case, the economic depreciation approach (see next section) is more relevant.

11.2.6 Economic depreciation

It is possible to modify the tilted annuity formula to compute annuities that take into account the evolution of the output volume produced by assets. This is referred to as the economic depreciation approach.

The same formula as the tilted annuity one is used, except that the constant annuity A_1 is replaced by C x N_i where C is constant and N_i varies in the same way as the number of outputs. Let *I* be the investment, *C* the constant unit cost, *p* the tilt (price trend of asset) and N_i the number of outputs sold in year *i*. The investment can be computed as follows:

$$I = \sum_{i=1}^{n} \frac{A_1 \times (1+p)^{i-1}}{(1+\omega)^i}$$

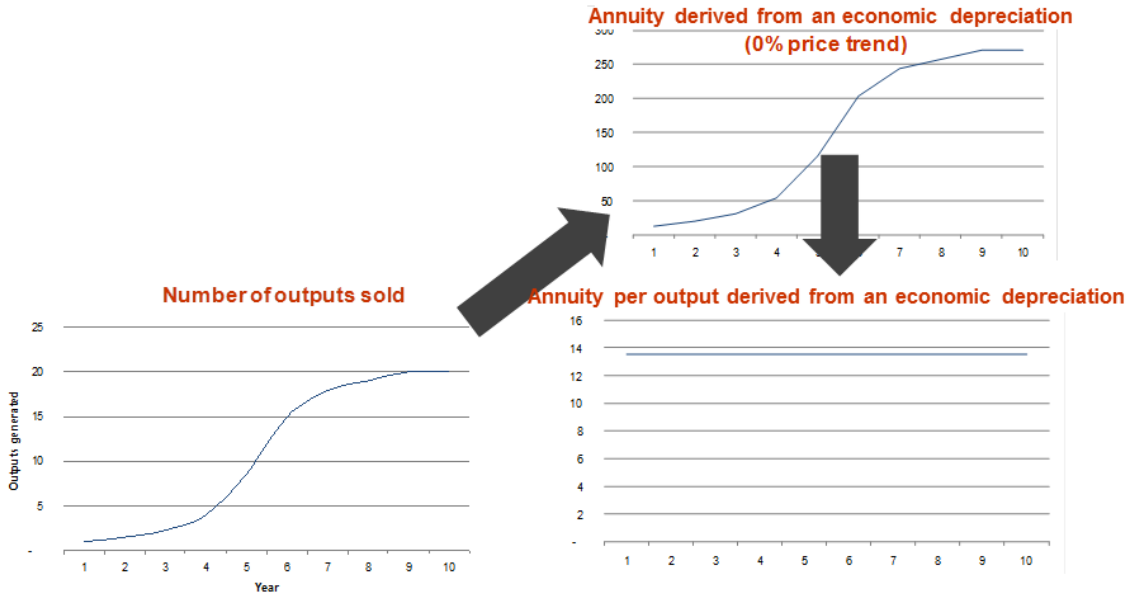
Becomes

$$I = \sum_{i=1}^{n} \frac{C \times (1+p)^{i-1} \times N_i}{(1+\omega)^i}$$

The annuity varies here with the output volume produced using the assets and with the price trend. When the asset produces a low output volume (for example, a new network in early years when there are few customers), the annuity is low at first and then increases when the output volume produced increases (for example, a new network's penetration rate increases).

The figure below illustrates the economic depreciation method (without taking into account evolution of asset prices) with which the unit cost per output is stable.

Figure 20: Annuities (depreciation charges plus return on capital employed) under the economic depreciation method



By accounting for changes in the number of outputs produced, annuities reflect changes in the market value of the asset, which corresponds to the definition of economic depreciation. The annuity per output remains stable and follows the evolution of asset prices.

The main drawback of this depreciation method is that it requires forecasts on the number of outputs produced by an asset over a long period of time. As a consequence, it is more subjective than other methods (even if the tilted annuity method is also somewhat subjective in setting long term price trends). However, it tends to give better economic signals than other depreciation methods when the number of outputs produced by an asset is not stable.