TSLRIC literature review on UBA and UCLL costing approaches

ComCom New Zealand

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1 Objective and methodology

The New Zealand Commerce Commission (ComCom) has requested TERA to conduct a literature review on the Total Service Long Run Incremental Cost (TSLRIC) objectives identified in recent literature. Two main criteria have been defined for the selection of appropriate research articles by economists:

- Research results that are as neutral as possible: during the selection of articles, it was observed that many studies, potentially relevant to the review, turned out to be financially supported by prominent telecommunications operators. The results of these studies therefore cannot be said to be wholly independent. TERA Consultants has therefore tried to verify the independence of the articles before including them in the final selection.
- Research articles that have been published in the last 5 years: this criterion is established due to the fast changing nature of the telecommunications market, as well as the need for regulatory policies to be updated and relevant to the markets that they aim to address.

It is observed that research articles by economists do not in general address a specific approach to regulatory cost modelling of access products. The research tends to focus on a more fundamental question: what is the relationship between the regulatory frameworks of access pricing and the level of investment in network deployment? In particular, many economists try to evaluate whether access regulation will have an impact on investment decisions by operators in the context of migration to the next generation access (NGA) network.

Given the criteria and the observation, eight articles have been selected for the review. The main findings from these articles are given in Annex 2.

To assist in the development of what the purpose of TSLRIC could be, lessons on modelling from overseas that are transferable to the New Zealand context have been identified. This document, therefore, focuses on an overview of the approaches used in TSLRIC models in European countries as opposed to being a comprehensive literature review.

1.1 Methodology for the review of TSLRIC models developed in European countries

In Europe, the LRIC approach is widely used and debated, especially in the context of UCLL (usually called “Local Loop Unbundling” or “LLU” in Europe) and UBA (usually called “Bitstream” in Europe).

Two main criteria have been defined for the selection of appropriate European regulatory authorities to be studied:

1 the regulatory authority must have implemented the TSLRIC approach, or at least must have conducted a detailed analysis on this approach;

2 sufficient information must be publicly available in order to provide detailed insights to ComCom.

TERA Consultants has thus identified five relevant European regulatory authorities (in Sweden, France, Denmark, Ireland and Germany) as well as the European Commission / BEREC[1] that meet these two criteria.

As an additional analysis to these six regulatory authorities, TERA Consultants has also identified and studied two regulatory authorities – in Spain and in Italy – that *do* meet the first criterion on TSLRIC but *do not* meet the second criterion on detailed publicly available information; they are thus briefly reviewed in the Annex, Section 4.1.

More specifically, for each regulatory authority, the following elements are described:

1. LRIC objectives
2. Increment definition
3. Competition objectives and 'build or buy' signals[2]
4. Efficiency objectives
5. Scorched-node vs scorched-earth approach
6. Modern equivalent asset definition
7. Demand level
8. New entrant definition
9. Price control period
10. UBA specificities

These aspects are especially studied for UCLL, which is at the top end of the "ladder of investment" where alternative operators can best compete with the fixed incumbent.

The objectives for UCLL usually also apply to UBA, and its specificities are also studied where relevant.

The executive summary related to the review of TSLRIC models developed in Europe is in Section 2 of this report; the detailed findings are in Section 3.

1.2 Methodology for the review of economic literature

As explained above, two main criteria have been defined for the selection of appropriate research articles by economists:

[1] Body of European Regulators for Electronic Communications, also known as the European Regulators Group (ERG).

[2] The competition in fixed access telecommunications networks is shaped by the "build or buy" signal sent to Other Alternative Operators (OAOs): "infrastructure-based competition' takes place when a OAO "builds" its own infrastructure, whereas 'service-based competition' takes place when a OAO "buys" some network elements from the incumbent. Therefore, any regulatory policy promoting service-based competition is concerned with not undermining the incentives for infrastructure-based competition. As the European Commission stated in its 2000 Regulation on LLU: "*Pricing rules for local loops should foster fair and sustainable competition, bearing in mind the need for investment in alternative structures, and ensure that there is no distortion of competition, in particular no margin squeeze between prices of wholesale and retail services of the notified operator*" (EC Regulation n°2887/2000, Whereas 11).

1. Research results that are as neutral as possible: during the selection of articles, it was observed that many studies, potentially relevant to the review, turned out to be financially supported by prominent telecommunications operators. The results of these studies therefore cannot be said to be wholly independent. TERA Consultants has therefore tried to verify the independence of the articles before including them in the final selection.
2. Research articles that have been published in the last 5 years: this criterion is established due to the fast changing nature of the telecommunications market, as well as the need for regulatory policies to be updated and relevant to the markets that they aim to address.

The application of both criteria leads to a selection of eight economic articles for the review:

1. Brito et al. (2010)
2. Cave (2010)
3. Klumpp and Su (2010)
4. Bender and Götz (2011)
5. Bourreau et al. (2011)
6. Nitsche and Wiethaus (2011)
7. Briglauer et al. (2012)
8. Kongaut and Bohlin (2012)

The main findings are given in Annex 2 (section 4.2).

2 Review of TSLRIC models developed in Europe – Executive summary

The purpose of this review of Unbundled Copper Local Loop (UCLL) and Unbundled Bitstream Access (UBA) Total Service Long Run Incremental Cost (TSLRIC) approaches in Europe is to inform choices that ComCom will have to make in the New Zealand context.

The TSLRIC approach refers to an economic method for the calculation of cost-orientated pricing that is based on:

> *"the forward-looking costs over the long run of the total quantity of the facilities and functions that are directly attributable to, or reasonably identifiable as incremental to, the service, taking into account the service provider's provision of other telecommunications services; and includes a reasonable allocation of forward-looking common costs".*[3]

The TSLRIC approaches (generally called LRIC or LRAIC or BU-LRIC[4] approach in Europe) taken by six regulatory authorities (five countries with Sweden, France, Denmark, Ireland, Germany plus the European Commission/ERG) have been studied.

The benchmark shows that there is a wide variety of approaches used to implement a TSLRIC methodology for UCLL and UBA by regulatory authorities across Europe. The variations in approach taken by different regulatory authorities for UCLL can be seen with reference to "Table 1 – UCLL main findings".

As the objectives for UCLL also apply for UBA, the UBA is studied through its specificities compared to UBA and the main findings are presented in "Table 2 – UBA ".

[3] Telecommunications Act 2001, Schedule 1, Part 1, cl 1.

[4] LRIC = Long Run Incremental Cost / LRAIC = Long Run Average Incremental Cost / BU-LRIC = Bottom-Up Long Run Incremental Cost

Table 1 – UCLL main findings

	European commission / BEREC	PTS (Sweden)	ARCEP (France)	DBA (Denmark)	ComReg (Ireland)	BNetzA (Germany)
UCLL TSLRIC objectives	• Replicate competitive markets • Ensures cost recovery • Provide appropriate 'build or buy' signal	• Use of existing facilities • Investment • Transparency • Predictability	• Non-discriminatory pricing • Efficient investment by incumbent • Efficient investment by Alternative Operators (AOs)	• Mimic cost levels in a competitive and contestable market • Ensure normal profit and return on efficient investment	• Set correct investment incentives • Only efficient costs to be recovered • Maximize consumer benefit	• Balance between access provider, access seeker, and competitors (cable & FTTH)
Increment definition	• All services of the SMP operator	• All services of the SMP operator	• All copper lines of the SMP operator	• All services using access network	• All copper lines of the SMP operator but calculation limited to a maximum access loop length of 5km	• All services to use access network
Competition objectives and build or buy signal	• 'Build' for duplicable assets (equipment, copper loop, next generation loop) • 'Buy' non duplicable asset (reusable civil engineering)	• Appropriate build or buy signal • Investment incentive for the incumbent	• 'Build or buy' irrelevant as the local loop will never be rebuilt • Promotes UCLL-based competition	• Appropriate build or buy signals • Reduce uncertainty on costs change over time	• Appropriate build or buy price signals • Provides future price movements and market behaviour for investment	• Provide optimal pricing to get relevant 'build or buy' signals
Efficiency objectives (see below Table 2)	• Static efficiency (maximising consumer and producer surplus) • Dynamic efficiency (incentives to invest in NGA)	• Not specified	• Efficient investments by SMP operator must be fully recovered	• Assessment of productive efficiency of regulated operator	• Provision of efficient investment incentives only when consumer welfare is increased	• Promote efficient investment

	European commission / BEREC	PTS (Sweden)	ARCEP (France)	DBA (Denmark)	ComReg (Ireland)	BNetzA (Germany)
Scorched-node vs scorched-earth	• (BEREC) Modified scorched node	• Modified scorched node	• Scorched node (top-down model)	• Modified scorched node	• Scorched node	• Scorched node
MEA	• Recommends fibre (FTTC or FTTH)	• Fibre + FWA	• Not discussed • Various options to deal with transition from copper to fibre and the upward impact on ULL prices	• FTTH is MEA for copper and cable-TV access networks but cost adjustment to derive copper price • VoIP is MEA for PSTN	• Not specified	• Copper is modelled but also fibre
Demand	• Whole demand (copper and fibre)	• Whole demand	• Whole incumbent demand	• Each network topology supports 100% of demand in a given area	• Based on current and forecast of incumbent demand • Only lines to be unbundled by AOs	• Current and forecasted demand to be delivered by SMP operator
New entrant	• Not specified	• Not specified	• Not specified	• Not specified	• LLU: Not specified • Bitstream: reasonably efficient operator with lower market share than SMP	• Not specified
Price control period	• 3 years	• 3 years	• 3 years	• Yearly update	• 3 years	• 2 to 3 years

Table 2 – UBA main findings

	European commission / BEREC	PTS (Sweden)	ARCEP (France)	DBA (Denmark)	ComReg (Ireland)	BNetzA (Germany)
UBA TSLRIC objectives[5]	• Foster competition only where LLU is not economically viable	• Foster competition without foreclosing LLU	• Foster competition without foreclosing LLU	• Foster competition without foreclosing LLU	• Foster competition without foreclosing LLU where LLU is likely (mainly large exchanges)	• Foster competition without foreclosing LLU
Approach	• Emphasizes the importance of 'economic space' with UCLL • Reminds that with sufficient competitive pressure, remedies for UBA may be lifted (in areas where UCLL is strong)	• LRIC with extra margin	• Cost orientation (LRIC) only in areas with no UBA competition • No remedies in areas with UBA competition	• LRIC based on the volumes of the SMP operator	• Ceiling for efficient cost-recovery • Floor for sufficient economic space for an AO	• *Ex-post* margin squeeze test

[5] As the objectives for UCLL also apply for UBA, the UBA objectives in this table are in addition to the UCLL objectives outlined above.

	European commission / BEREC	PTS (Sweden)	ARCEP (France)	DBA (Denmark)	ComReg (Ireland)	BNetzA (Germany)
Specificities	• N/A	• For the MEA the bitstream network should be valued with the Ethernet technology • The demand should include the total demand for leased lines, bitstream and other data services	• N/A	• For allocative efficiency, DBA recommends both capacity-based allocation and Shapley-Shubik allocation • The demand should include the total demand for leased lines, bitstream and other data services	• N/A	• N/A

3 Review of TSLRIC models developed in Europe – Key findings

3.1 European level (European Commission and BEREC)

The main document detailing the European Commission's view on the LRIC approach is the '*Commission Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment*'.

This was debated over more than one year and several drafts were published. The major goal of this recommendation is to harmonize costing and pricing approaches for UCLL between regulatory authorities in Europe. Indeed, very different approaches for costing and pricing UCLL are used across Europe (ranging from top-down approaches to bottom-up approaches). The goal is also to make sure the migration from copper to NGA is not penalised by inadequate pricing approaches because copper prices that are too low can be seen as "dis-incentivising" customers to migrate.

At the European level, the Body of European Regulators of Electronic Communications (BEREC, a group of European regulators that assists the European Commission in implementing the EU regulatory framework, formerly called ERG, i.e. European Regulatory Group) has also published some reports which give further guidance for UCLL and UBA pricing in Europe.

3.1.1 LRIC overall objectives

The European Commission Recommendation states that LRIC is the best costing methodology to meet the following objectives[6]:

1. It leads to access prices replicating as much as possible those expected in an effectively competitive market based on:
    a. a modern efficient network;
    b. stable and predictable wholesale copper access prices over time, which avoid significant fluctuations and shocks;
    c. a clear framework for investment;
    d. cost-oriented wholesale copper access prices serving as an anchor for NGA services;
    e. an appropriate and consistent approach with the impact of declining volumes caused by the transition from copper to NGA networks (i.e. avoiding an artificial increase in wholesale copper access prices which would otherwise be observed as a result of customers migrating to the NGA network of the SMP operator).

[6] European commission recommendation on costing methodologies, 2013 (p.7)

2. It ensures cost recovery, which is a key principle in a costing methodology. In other words, it ensures that operators can cover costs that are efficiently incurred and receive an appropriate return on invested capital.
3. It provides the appropriate 'build-or-buy' signal that strikes an appropriate balance between ensuring efficient entry and sufficient incentives to invest and to deploy NGA networks.

NB: in a 2005 document, the ERG has defined LRIC as *"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."*[7] It is interesting to note that the acronym "LRIC" does not refer to efficiency but that the concept of efficient operator is linked to the LRIC concept by the ERG and generally by regulatory authorities in Europe.

3.1.2 Increment definition

The increment is defined as all the services that a fixed network should be required to deliver[8]:

> *"The BU-LRIC* [bottom-up LRIC] *methodology calculates the current costs on a forward-looking basis (i.e. based on up-to-date technologies, expected demand, etc.) that an efficient network operator would incur to build a modern network today,* ***one able to provide all required services****. Therefore, BU-LRIC provides correct and efficient signals for entry." (Emphasis in original)*

3.1.3 Competition objectives and 'build or buy' signals

The competition objectives are mostly considered by the European Commission as an efficiency issue (see next section). Regarding the build-or-buy signal, the European Commission stresses the importance of striking a balance between ensuring efficient entry and ensuring cost recovery as an incentive to invest[9]:

> *"A costing methodology that provides the appropriate 'build-or-buy' signal strikes an appropriate balance between ensuring efficient entry and sufficient incentives to invest and, in particular, to deploy NGA networks and hence deliver new, faster and better quality broadband services."*

[7] 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

[8] European Commission recommendation on costing methodologies, 2013 (p.7)

[9] European Commission recommendation on costing methodologies, 2013 (p.7)

The European Commission does not specifically detail what entails a 'build' strategy for a new entrant, but hints that it should include some part of the '(re)built' network as including some fibre:

> *"For copper-based services the only sensible reference for a build-or-buy decision are* ***networks which are partly or fully based on fibre,*** *i.e. cable, LTE, and FTTX networks. SMP operators are themselves upgrading or replacing their copper networks with NGA networks."*

This is confirmed in its replicability assessment of the principal asset categories along a broadband network value chain. This provides a good view of which assets a new entrant could 'build' to compete against the SMP operator, or even which asset a SMP operator needs to '(re)build'.

The three assets that can be included in the 'build' signal are the equipment, the copper loops and the next generation loops[10]:

> *"**Equipment.** These assets are considered to be the most replicable network elements. (…)*
>
> ***Copper loops.** Copper loops appear to be replicated in an increasing number of countries/regions where cable, fibre and mobile networks are competing against the copper networks. This competitive threat obliges incumbents to upgrade their copper networks and progressively replace them with fibre. (…) Current costs would therefore be proposed as the asset valuation method for the copper loops, where the replacement cost based on NGA technologies (either fibre or a mix of fibre and copper) would be calculated. (…)*
>
> ***Next generation loops.** Next generation loops have at least the same potential as copper loops to be replicated since fibre constitutes the competitive response to alternative infrastructures such as mobile and cable. (…) Some alternative operators are already deploying their own fibre networks and new business models are emerging (such as co-investment)."*

The asset that is not included in a 'build' signal (i.e. that will not be replicated) is the civil engineering infrastructure (ducts, trenching and poles).

> *"Civil works are characterised by little technological development (although some changes may occur, e.g. micro-trenching) and rising real costs (labour costs) over time showing that replicating* ***the access infrastructure is too costly and therefore there is no/little prospect of assets such as trenches and poles being duplicated.***
>
> *Since the competitive process would most likely not lead to these assets being replicated, estimating the costs incurred by a new efficient operator in deploying a new civil infrastructure network would not be required (within the* ***"build-or-buy" investment decision*** *the option to build a civil infrastructure would no longer be considered as an option for a new entrant)."*

[10] European commission recommendation on costing methodologies, Impact assessment, 2013 (Annex 7)

However, the European Commission is of the view that the exclusion of the civil engineering infrastructure from a 'build' strategy for a new entrant only makes sense if the infrastructure can be reused. In the case of non-reusable civil engineering assets (legacy civil engineering assets that are used for the copper network but cannot be reused to accommodate an NGA network), a new civil engineering infrastructure will have to be deployed (either by the incumbent or a new entrant) to accommodate the deployment of NGA.

3.1.4 Efficiency objectives

Although the European Commission stresses the need for 'efficiency' in its Recommendation, it does not specifically detail how such efficiency will be assessed and what types of efficiencies it wants to promote:

> *"The present Recommendation aims to promote **efficient** investment and innovation in new and enhanced infrastructures whilst recognising the need to maintain effective competition, which is an important long term investment incentive."*[11]

> *"Cost recovery is a key principle in a costing methodology. It ensures that operators can cover costs that are **efficiently incurred** and receive an appropriate return on invested capital."*[12]

The European Commission also published an Impact assessment along with its Recommendation. The Impact assessment provides a framework to assess efficiency, as the European Commission details that when setting (price and non-price) access conditions there is a fundamental balance to be found between (i) promoting competition and efficient entry with the ensuing benefit for consumers ('static efficiency'), and (ii) providing sufficient incentives for (sunk, irreversible) investments ('dynamic efficiency')[13].

- Assessing **static efficiency** requires a static analysis of welfare, i.e. the overall impact on consumers and producers of the possibility for competitors to replicate the offers of the SMP operator, as well as the impact of the level of access charges that are prevalent at the wholesale level.
- The analysis of the **dynamic efficiency** requires an analysis of the impact of those factors on investment incentives and the provision of new services, and in particular on NGA investments.

However, the European Commission is very cautious when quantifying the efficiency of its (recommended) approach, stating that this is highly dependent on local specificities:

> *"It is very difficult to fully assess the impact of the proposed approach in the individual Member States in quantitative terms, given that competitive and*

[11] European Commission recommendation on costing methodologies, 2013 (p.2)

[12] European Commission recommendation on costing methodologies, 2013 (p.7)

[13] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.53)

> *structural national circumstances (e.g. infrastructure, market and competition developments as well as geographical topologies, labour costs and inflation rates) also determine the level of the underlying costs independently of the costing methodology applied by the NRAs. Even if all regulators in all Member States applied the recommended approach, the outcome would still reflect these national specificities. In addition, the overall outcome in terms of competition and consumer surplus, will not relate solely to the implementation of the recommended approach; it of course also depends to a large extent on externalities."*[14]

The European Commission does not provide further details on how to assess the efficiency of its approach, and only lists the results of several economic studies that were performed on its behalf. For the purpose of this benchmark it is sufficient to remember that for the European Commission, the static efficiency refers to **maximising consumer and producer surplus**, and dynamic efficiency refers to the **providing incentives to invest in NGA**.

3.1.5 Scorched-node vs scorched-earth approach

The European Commission does not deal with this aspect. This subject is too detailed to be addressed in a recommendation of the European Commission. It is however to be noted that at the European level, the European Regulators Group (ERG that became BEREC afterwards) stated in 2005 that the modified scorched node approach was the most relevant approach[15]:

> *"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.*
>
> *It can be appropriate to modify the scorched node approach in order to replicate a more efficient network topology than is currently in place. Such a modified scorched node approach could imply taking the existing topology as the starting point, followed by the elimination of inefficiencies. This may involve changing the number or types of network elements that are located at the nodes to simplify and decrease the cost of the switching hierarchy. Other important issues in this respect are how to deal with spare capacity in the network and the existence of stranded costs.*

[14] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.53)

[15] 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

When the modified scorched node approach is not applicable because the elimination of inefficiencies is not practical, it could be more appropriate to use a scorched earth approach".

3.1.6 Modern equivalent asset definition

The European Commission recommends having a single model to set both copper and NGA access prices. It states that the copper access price must be calculated by adjusting the NGA costs (to reflect the different features of wholesale access services based entirely on copper). It also explains that using the MEA as fibre is the best way to counteract the migration effect from copper to fibre (see next section):

"*NRAs would be recommended to build a single BU LRIC model to set both the copper and NGA access prices. While NGA access prices (where they are regulated) would be determined by direct application of the model,* ***copper access prices would be determined by adjusting the costs to reflect the different features of wholesale access services based entirely on copper.*** *Such approach would properly reflect the competitive process and not distort the build-or-buy investment decision since it recognizes that NGA-based products can be sold at a premium on retail markets.*"[16]

"*The use of MEA counteracts the volume effect (due to decreasing demand) and yields more stable cost estimates.*"[17]

3.1.7 Demand level

The European Commission recommends taking into account the whole demand (copper plus NGA) for the calculation. [18]

"*Stability would be reached by calculating the access costs of an NGA network and thus counteracting the volume effect (due to decreasing demand) which has been leading to higher unit costs.*

Such volume effects would see copper prices rising as customers switch to NGA products, because the same cost base of copper would be distributed between a smaller number of lines.

In the proposed methodology, the model includes both copper and NGA lines, and therefore only traffic volume moving to other infrastructures (e.g. cable, mobile and alternative operators' fibre) would entail an inflation of unit costs."

[16] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.43)

[17] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.89)

[18] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.44)

3.1.8 New entrant definition

The European Commission does not deal with this aspect.

3.1.9 Price control period

The European Commission recommends a price control period of (at least) three years:

> *"NRAs should publish the updated outcome of the costing methodology and resulting access prices over the relevant three-year period."*[19]

3.1.10 UBA specificities

The European Commission does not provide additional specificities for bitstream. However it notes that the competitive constraints faced by an incumbent operator from alternative operators that have access to local loop unbundling (LLU) can lead to a removal of remedies in the bitstream market. Indeed as alternative operators buying LLU become able to offer bitstream, the incumbent is likely to face sufficient competitive pressure that warrants a lift of the remedies for bitstream (in areas where alternative operators have unbundled exchanges). [20]

It is also interesting to summarize the view of the BEREC on bitstream. The BEREC emphasizes that the tariff for UBA should be set with respect to the tariff for LLU so as to provide a reasonable "economic space". The "economic space" refers to the price difference between bitstream and LLU, and should be:

- wide enough so as to keep a strong incentive for alternative operators to use LLU and extend the LLU coverage as much as possible (if the economic space was deemed too low then alternative operators would have no economic interest in using LLU instead of bitstream);
- but not too wide as it would carry the risk of increasing retail prices in remote areas (i.e. areas where LLU is not economically viable for alternative operators).

[19] European Commission recommendation on costing methodologies, 2013 (p.22)

[20] European Commission recommendation on costing methodologies, Impact assessment, 2013 (p.50)

3.2 PTS (Sweden)

The main document detailing the PTS' LRIC approach is the '*Model Reference Paper – Guidelines for the LRIC bottom-up and top-down models*'.

Unfortunately the Final Model Reference Paper is only available in Swedish. This note will thus rely on the Draft Model Reference Paper which was available for consultation in English (it is assumed that there are no major changes between the Draft MRP and the final MRP).

3.2.1 LRIC objectives

For PTS the objectives of using LRIC are to[21]:

1. Encourage the use of existing facilities of the SMP operator where this is economically desirable, avoiding inefficient duplication of infrastructure costs by new entrants (incentive to buy);
2. Encourage investment in new facilities where this is economically justified by:
    a. new entrants investing in competing infrastructure;
    b. the SMP operator upgrading and expanding its networks (incentive to build);
3. Increase the transparency of the cost calculations underlying the access charges; and
4. Increase predictability for both the SMP operator and the other operators with regards to future determination of access charges.

It is to be noted that point 3 is mainly achieved by the use of a bottom-up cost modelling approach.

3.2.2 Increment definition

According to PTS, LRIC means the incremental costs corresponding to a time horizon where all factors of production, including capital equipment, are variable in response to changes in demand due to changes in the volume or in the structure of production. Therefore all investments are considered as variable costs[22].

To send the right investment signals and promote efficient competition, prices should reflect the LRIC of an efficient operator facing the demand of the existing SMP operator. The efficient operator is defined as the theoretical operator that would exist if it were in a fully competitive market, but with the same scope and demand of the existing SMP operator. This approach ensures that the economies of scale, scope and

[21] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§1.1.1).

[22] European Commission recommendation on costing methodologies, 2013 (p.16)

density are divided equally between the SMP operator and the alternative operators allowing the alternative operators to compete with the SMP operator on equal terms[23].

3.2.3 Competition objectives and 'build or buy' signals

According to PTS, the LRIC approach ensures an appropriate build or buy signal for new entrants while at the same time providing a strong investment incentives for the incumbent.[24]

> *"When access charges are based on LRIC they do not distort the build/buy decision of new entrants – they will be encouraged to use existing facilities if, and only if, it is economically desirable to do so. Just as important, LRIC-based access charges also mean retaining investment incentive for incumbents to upgrade or extend the existing network when new technology is available.*
>
> *When charges are set on the basis of LRIC, infrastructure competition is encouraged in those areas where it is efficient to have competing infrastructure, whereas service competition is encouraged in those areas where the investment in competing infrastructure is not efficient."*

3.2.4 Efficiency objectives

PTS does not clearly detail how efficiency should be assessed in its model reference paper.

3.2.5 Scorched-node vs scorched-earth approach

A node is defined by PTS as an equipment location (which might contain voice telephony, concentrators, DSLAMs and IP switches and routers, etc.). This implies that there may be more than one node at a site since different types of equipment are often co-located.

For LRIC modelling purposes, the scorched node assumption is often used, taking as given the existing number and location of the SMP operator's nodes. However, to ensure that the SMP operator has incentives to migrate to a more efficient architecture, the model should comply with a 'modified' scorched node approach to allow for certain optimisations. Hence, for PTS, the number of nodes is fixed, and the degree of optimisation refers to changes in the nature of nodes. The mix of equipment, therefore, may be changed. For example, a legacy PSTN switch might be replaced by its NGN equivalent, or a DSLAM might be replaced by an MSAN.

[23] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§1.2).

[24] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§1.1.2).

> *"The bottom-up model should comply with the modified scorched node assumption where nodes are defined as equipment locations. The existing number and locations of sites are fixed, but no empty sites are allowed although it is possible to change the number and mix of equipment at a site."*[25]

3.2.6 Modern equivalent asset definition

According to PTS, the MEA may be defined as one with the required capacity and functionality that, on a forward looking basis, has the lowest (discounted) cost.

If there are differences in operating costs between the MEA and the existing asset, the MEA valuation of the existing asset must also be adjusted to reflect these. The differences may arise, for example, due to differences in maintenance costs, network management costs and associated indirect costs. Finally, when selecting the MEA, differences in asset lives should also be taken into account[26]. The aim of PTS in setting the MEA is to create neutral incentives for infrastructure investment[27].

All in all, fibre is the main MEA retained by PTS:

> *"The access network in the bottom-up model should be modelled using a fibre access network as the appropriate modern technology. However, radio may be modelled as suitable modern technology where this is cost effective."*[28]

According to PTS, using fibre and wireless as MEA for copper minimises the forward-looking cost of the infrastructure.

To justify this choice, PTS indicates that:

- Fibre is an efficient choice considering the capacity demand in the future;
- Fibre roll-out is observed on a large scale in Sweden whereas new deployment of copper is almost non-existent;
- Fibre is the new infrastructure which an operator would choose to deploy in Sweden.

It is interesting to note that according to PTS, the use of fibre as MEA for copper does not impact the valuation of trenches, poles and ducts, which are assumed to be new and valued on the basis of their replacement cost.

PTS also considers wireless infrastructure to be the MEA to replace copper in low density areas where only voice or low capacity leased lines are provided and where high speed services are unlikely to be offered in the foreseeable future.

[25] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§12.1).

[26] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§6.3).

[27] European Commission decision concerning Case SE/2011/1205, 2011.

[28] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§12.2.2).

NB: PTS estimates that the costs for fully unbundled access based on copper would be similar to or slightly higher than the costs for fully unbundled access based on fibre.

NB: PTS proposes a national average price for copper but geographically de-averaged prices for FTTH. This may lead to a situation where in city areas copper access would be more expensive than fibre access, whereas in rural areas copper access would be cheaper. For the European Commission, investment incentives may be adversely affected.

3.2.7 Demand level

The starting point for the traffic demand is the existing traffic currently travelling over the SMP operator's network, as evidenced by the actual volumes sold[29].

3.2.8 New entrant definition

PTS does not deal with this aspect.

3.2.9 Price control period

The price control period is usually set to 3 years.

3.2.10 UBA specificities

The PTS also applies the LRIC approach for UBA and thus all the previous findings for UCLL apply for UBA.

There are however some specificity:

- For MEA, the broadband/bitstream network should be valued using Ethernet and not ATM based DSLAMs. [30]
- For the demand, the model should include the total demand for leased lines, broadband/bitstream and other data services (in terms of number of circuits/subscribers by capacity bandwidths) and the demand for broadband/bitstream should be shown by different categories of services and, within each category, by different capacity bandwidths. [31]

PTS specifies that the "economic space" (i.e. a percentage rate over the cost of bitstream access services derived from the LRIC model) based on full and shared

[29] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§3.2.1).

[30] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§7.3.2).

[31] PTS, Draft Model Reference Paper, Guidelines for the LRIC bottom-up and top-down models, (§13.2.1).

unbundled lines amounts in 2011 (and until the next publication of the pricing method) to 9% and 6%, respectively[32].

3.2.1 Key drivers reviewed

In compliance with the current regulations for the LRIC model in Sweden, PTS must update the cost data of the model for the fixed network every year. According to PTS, in 2013, the main changes were related to:

- Number of lines for UCLL;
- Voice traffic, data consumption and number of broadband subscribers for UBA[33].

[32] European Commission decision concerning Case SE/2011/1205, 2011.

[33] Commission Decision concerning Case SE/2012/1379: Price related remedies in Sweden. Comments pursuant to Article 7(3) of Directive 2002/21/EC

3.3 ARCEP (France)

3.3.1 (LRIC) Objectives

Initially the ART (former name of ARCEP) relied on a LRIC costing approach to set rates for UCLL.

However, in 2005, ARCEP conducted a review of alternative costing methodologies and later in that same year issued a decision outlining a revised costing approach for local loop unbundling (LLU) services[34].

Although the LRIC approach was not kept, the objectives pursued through the LRIC approach were kept, that is to say:

1. Achieve non-discriminatory pricing (i.e., between the internal prices paid for the services in question by the incumbent France Telecom and alternative operators);
2. The encouragement of efficient investment by France Telecom;
3. The encouragement of efficient investment by alternative operators.

ARCEP rejected the use of LRIC as it considered that this approach only made sense in a situation where the local loops could be rebuilt (see section below), which was not the case. Instead, it opted for a CCA-based approach with economic depreciation ("*coûts courants économiques*"). The specificity of ARCEP's approach (which is unique to our knowledge) is that costs are derived from the accounts but investments coming from the accounts are depreciated using a tilted annuity rather than an accounting depreciation method.

3.3.2 Increment definition

The ARCEP defines the increment as being the entire copper lines of the SMP operator (France Telecom)[35].

3.3.3 Competition objectives and 'build or buy' signals

The ARCEP states that it is focusing on providing incentives to alternative operators to promote "effective competition" through unbundling (and thus the deployment of core networks) rather than the duplication of the copper local loop or the rise of alternative technologies (such as wireless fixed local loop) that are too costly and ineffective[36].

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[34] ARCEP, *Décision n°05-0834*, 2005 (p.5).

[35] Annexe II à la décision numéro 00-1171 de l'Autorité de régulation des télécommunications en date du 31 octobre 2000.

[36] ARCEP, *Décision n°05-0834*, 2005 (p.6).

The ARCEP clearly states that in the case of the local loop, the 'build or buy' approach is irrelevant as the local loop, which is an essential infrastructure, will never be rebuilt by alternative operators. The ARCEP thus promotes service-based competition, but with alternative operators investing to unbundle exchanges.

3.3.4 Efficiency objectives

Efficiency is only covered through the aspect of "efficient investments" for the incumbent operator. It implies that the SMP operator must fully recover its costs, as long as they are "efficient". No details are provided on how such efficiency is measured (apart from "based on best practices, directly linked to the output and forward-looking to anticipate renewal of assets") [37].

3.3.5 Scorched-node vs scorched-earth approach

The ARCEP does not deal with this aspect as a top-down approach is used to set UCLL prices (which is thus inherently scorched-node).

3.3.6 Modern equivalent asset definition

The MEA issue is less relevant because ARCEP is using a top-down approach. However, in December 2011 the ARCEP issued a report[38] dealing with the transition from copper to fibre and the likely impact on UCLL prices. In the report, ARCEP states that the increasing deployment of fibre optic networks will reduce the customer base for copper, especially in dense areas (primary area of deployment for fibre). This can cause upward pressure on UCLL prices (because of the copper customer base reduction, the denominator is decreasing leading to an increase in unit prices). ARCEP is thus considering various options for addressing the ongoing transition from copper to fibre including:

- Avoiding "rate shock" and "yoyo effects" in the evolution of UCLL tariffs, to provide greater predictability to operators;
- Avoiding UCLL price increases due to declining demand on the copper network;
- Providing consistent signals for continued fibre deployment.

ARCEP has suggested that reducing copper asset lives while also extending the amortization period of the civil engineering infrastructure should assist in meeting these objectives[39]:

- Moving from 40 to 50 years for the civil engineering infrastructure;

[37] ARCEP, *Décision n°05-0834*, 2005 (p.6).

[38] ARCEP, *Rapport sur les coûts de la boucle locale cuivre de France Télécom et leur évolution dans le cadre de la transition du cuivre vers la fibre*, November 2011.

[39] ARCEP, *Durées d'amortissement des actifs de la boucle locale en cuivre de France Télécom*, 2011.

- Moving from 25 to 13 years for the copper cables.

3.3.7 Demand level

ARCEP does not deal with this aspect. Under a top-down approach the actual number of lines in use is considered.

3.3.8 New entrant definition

ARCEP does not deal with this aspect as a top-down approach is used.

3.3.9 Price control period

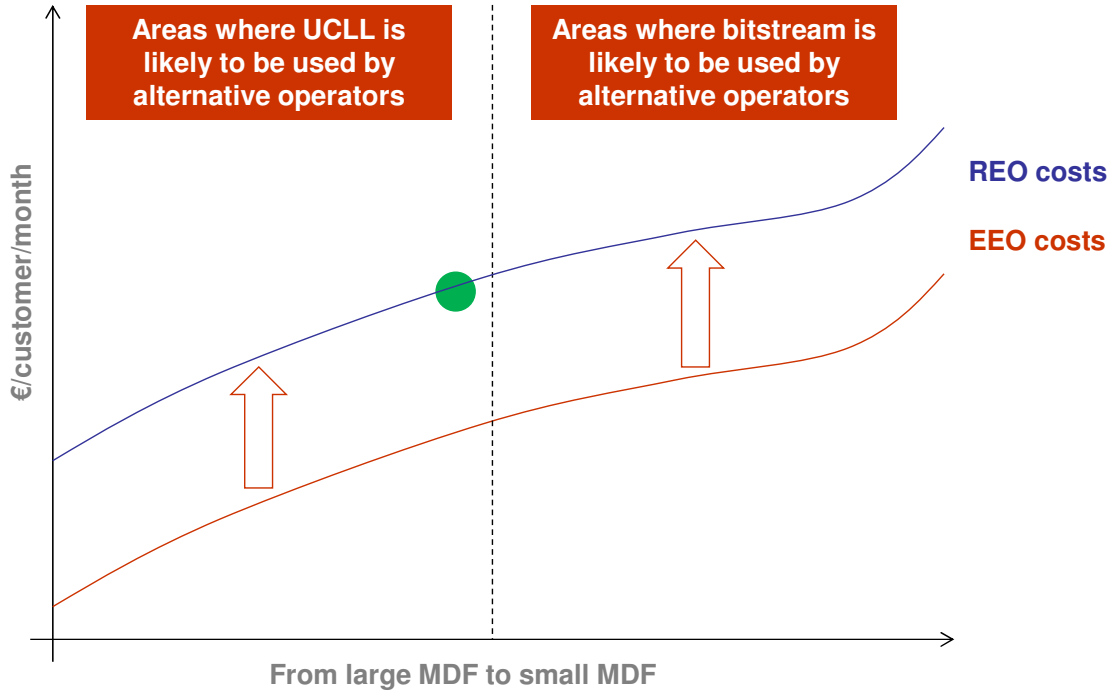
ARCEP usually sets the price control for a period of 3 years but prices can change more frequently.

3.3.10 UBA specificities

Between 2008 and 2011, France Telecom's UBA offer was regulated on a nationwide basis. Bitstream tariffs were set thanks to a cost orientation approach and had to be non-exclusionary for alternative operators: this implied that the bitstream tariff had to be "high enough" so that an alternative operator using LLU could itself deliver a competitive bitstream offer (the economic space was calculated based on the "average marginal NRA" that an alternative operator would unbundle).[40]

[40] ARCEP, *Modèle réglementaire du coût de l'accès dégroupé et du coût de la collecte*, 2012.

Figure 1 – Approach followed by ARCEP between 2008 and 2011 (the green dot represents the signal ARCEP intended to send)



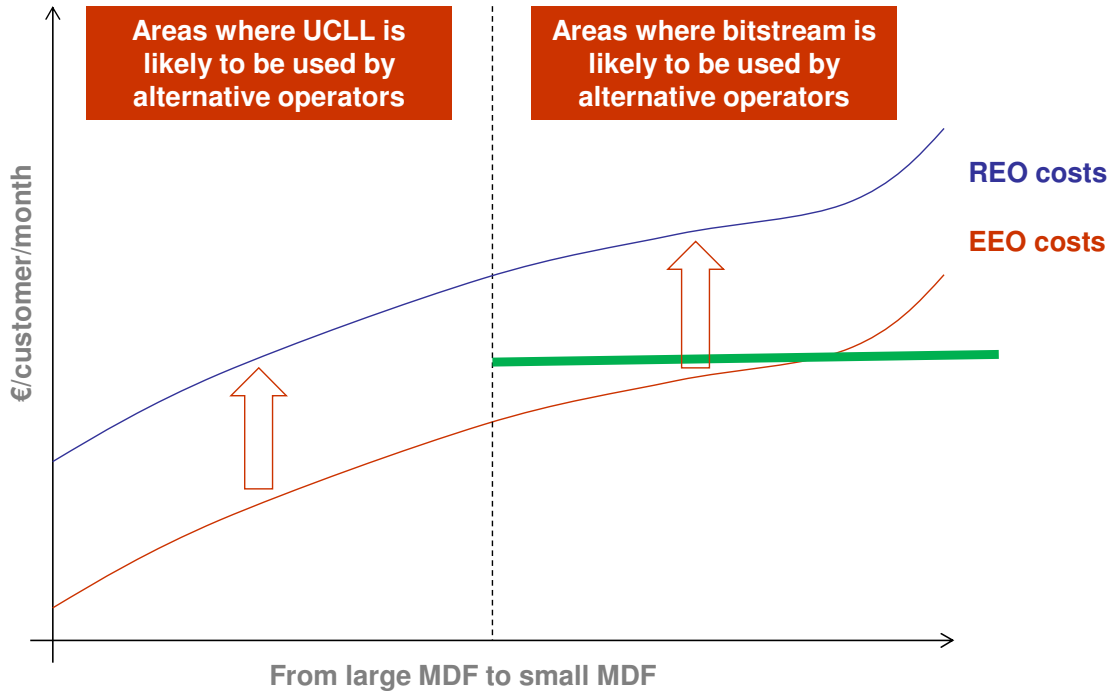
Source: TERA Consultants

Since 2011, ARCEP changed its approach for bitstream as market conditions evolved with the rise of a competitive wholesale bitstream market. ARCEP thus now distinguishes between two types of areas[41]:

- In areas where the incumbent France Telecom is the only operator offering bitstream, the ARCEP keeps the EEO bottom-up cost orientation approach to set UBA tariffs;
- In areas where alternative operators currently deliver an (alternative) wholesale bitstream offer, ARCEP removed the cost orientation obligation (but warned that it can call upon the French competition authority if it suspects that France Telecom is behaving anticompetitively i.e. abuse of its dominant position).

[41] ARCEP, *Decision 2011-0669*

Figure 2 – Approach used by ARCEP since 2011 (green line)



Source: TERA Consultants

NB: for UBA aimed at professional customers, ARCEP is however keeping a similar approach to the one previously in place.

3.3.11 Key drivers reviewed

When UCLL prices change (which can happen every year), ARCEP does not publicly specify the drivers for the change. However, for 2 recent changes, some reasons (maybe not all) have been provided:

- Change in the WACC in 2013[42];
- Change in asset lives in 2013[43].

[42] http://www.universfreebox.com/article/19565/France-Telecom-augmente-ses-tarifs-de-gros-notamment-en-degroupage

[43] http://www.arcep.fr/index.php?id=8571&tx_gsactualite_pi1%5Buid%5D=1480&tx_gsactualite_pi1%5Banne e%5D=2012&tx_gsactualite_pi1%5Btheme%5D=0&tx_gsactualite_pi1%5Bmotscle%5D=&tx_gsactualite_ pi1%5BbackID%5D=2122&cHash=ebf8cd121bf79553185eb9376bd2d658

3.4 DBA (Denmark)

3.4.1 LRIC objectives

The Danish regulatory authority developed a bottom-up LRIC model of a network building on the current physical network structure, but optimized with respect to technology and configuration (the scorched node approach).[44] The incumbent was responsible for preparing a Top-down model based on the existing network. Based on these two models, the Danish Telecom Authority constructed a hybrid LRIC model, in which traffic data is revised every year, while technology assumptions are changed less frequently.

An updated LRIC Model reference paper was published in 2013[45].

The objectives of the LRIC approach are to mimic as much as possible the level of costs in a competitive and contestable market:

> *"Long-run incremental costs (LRIC) based on an efficient deployment of a modern asset reflect the level of costs that would occur in a competitive and contestable market. Competition ensures that operators achieve a normal profit and normal return over the lifetime of their investments (i.e. in the long run). Contestability ensures that existing providers charge prices that reflect the costs of supply in a market that can be entered by new players using modern technology.*
>
> *Together these ensure that inefficiently incurred costs are not recoverable and require a forward-looking assessment of an operator's cost recovery (as a potential new entrant is unconstrained by historical cost recovery)."*[46]

3.4.2 Increment definition

For the access network, the increment should include all services that use the access network.

3.4.3 Competition objectives and 'build or buy' signals

From a regulatory point of view, the LRIC method based on the MEA concept and implemented using the bottom-up approach can:

[44] Ole Jess Olsen, Access pricing in Danish telecommunications and electricity, 2008.

[45] DBA, Model reference paper, 2013.

[46] DBA (NITA at the time), Final Model Reference Paper, 3 September 2010.

- give a good understanding of regulated operator's cost structure (it is a transparent approach) and enables one to determine more accurately the changes in cost over time under uncertainty or where cost structures are expected to change;
- enable one to deal with efficiencies since costs are derived from service demand through established engineering rules;
- enable one to model the costs of services that have not yet been introduced or that have just been introduced;
- enable DBA to send appropriate "build or buy" signals. If regulated prices to access the assets are set based on the MEA concept, it is equivalent for an alternative operator to buy access or to invest in an equivalent asset.

According to DBA, one of the potential drawbacks of the LRIC concept is that it is not necessarily linked to the costs actually incurred by the regulated operator. For example, LRIC models may apply a positive value to assets that are fully depreciated in operator's accounts. Also, in areas where alternative operators are unlikely to deploy alternative infrastructure, the MEA and LRIC concepts may be less relevant for price setting. However, where NGA is deployed, it is representative of the costs an efficient player would face.

3.4.4 Efficiency objectives

The model reference paper states that the productive efficiency of the regulated operator will be assessed, but does not provide details on how the efficiency adjustment will be performed. In practice, comparisons with other operators in Denmark or with other countries are conducted to assess the level of efficiency of costs that are measured.

3.4.5 Scorched-node vs scorched-earth approach

DBA interprets the Scorched Node constraint such that when modelling an "optimally structured network" under the scorched node assumption the locations for equipment are constrained by the existing number of sites and their existing locations. However, the scorched node assumption does not imply that the transport network - cables, duct/trench etc. - is fixed. Nor does the assumption imply that the same number and type of equipment should be placed at each of these geographical locations. The equipment should be placed at the existing geographical locations of the SMP operator's network nodes.

3.4.6 Modern equivalent asset definition

DBA has conducted a modern equivalent asset (MEA) assessment aiming at answering the following two questions:

- What is the MEA for copper and cable-TV?
- Is VoIP a MEA for PSTN?

Following the public consultation process on the MEA assessment[47], it was decided that:

- FTTH is the MEA for copper and cable-TV access networks (their cost is calculated by adjusting the FTTH cost to reflect the lower capabilities of copper and cable-TV networks compared to FTTH);
- VoIP technology is the modern equivalent technology for PSTN.

The MEA assessment is carried out through the analysis of the different criteria that enable DBA to determine what the MEA of copper and cable TV access networks should be and by considering the following issues:

- Can products based on fibre essentially replace similar products based on copper/cable-TV?
- Comparison of the costs for rollout of fibre networks and copper/cable TV networks respectively.
- Does the observed market behaviour support an assumption of fibre as MEA? This issue is handled through the analysis of the subscriber criterion; the operator's strategy criterion and the retail price criterion.
- What are the best practices in terms of MEA assessment in other European countries?

For the vast majority of criteria, DBA's analyses support the assumption that FTTH is the MEA of copper and cable TV.

Table 3 – MEA criteria for DBA

Criterion	Is FTTH the MEA of copper?	Is FTTH is the MEA of cable TV?
Technological criterion	++	/
Cost criterion	- for CAPEX but + for OPEX	/
Subscriber criterion	++	+
Operator's strategy criterion	++	++
Retail price criterion	/	/
Best practices	+	/

Source: DBA

[47] DBA, Modification and development of the LRIC model for fixed networks 2012-2014 in Denmark MEA ASSESSMENT, February 2013.

Once DBA defined FTTH as the MEA of copper and cable-TV, DBA detailed how to adjust fibre prices to set copper and cable TV prices. Due to difference in performances, adjustments were seen by DBA as necessary:

> *"The MEA is the asset that can produce the stream of services produced by the existing asset at lowest cost. Where the operating cost or other performance characteristics of the MEA differ from the existing asset,* ***these should be reflected in the asset valuation****."*[48]
>
> *"Modern Equivalent Asset (MEA) should be used whenever it is possible, as it is the most accurate valuation criterion to reflect the cost of an efficient operator, since it will capture the associated costs (and efficiencies) that an entrant/alternative operator would face, if entering into the market at a specific time.*
>
> *This valuation criterion is accurate when besides a technical change; the asset with the same functionalities is no longer being marketed. Therefore,* ***the aim is to calculate the cost of an analogous (replacement) asset****."*[49]

In such a case, three possible adjustments have been identified by DBA to set price of copper and cable TV:

- Adjustment based on consumer preference;
- Adjustment based on technologies and performances;
- Adjustment based on costs.

For DBA, the aim of these adjustments is to compute a discount that will be applied on the FTTH price in order to set the regulated price of copper and cable-TV. All these adjustments are analysed in light of DBA's objectives with regards to price control obligations which consists in *"promot[ing] efficiency and sustainable competition and maximise consumer benefits"*[50]*, i.e.* in:

- Allowing efficient costs to be recovered;
- Ensuring that rates are not excessive;
- Also, in the specific case of migration from copper toward NGA and considering the EU 2020 agenda[51], it is also important to make sure that migration to NGA is not slowed down.

In the end, DBA states that due to its statutory objectives, the adjustment based on costs is the most relevant.

[48] Source: NITA, Model reference paper dated 18 September 2008, p.27.

[49] Source: ITU Regulatory accounting guide, March 2009, p.18

[50] 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)

[51] http://ec.europa.eu/europe2020/index_en.htm

3.4.7 Demand level

One of the specificities of Denmark is the presence of overlapping access networks owned by the incumbent (the incumbent owns a copper network and a cable-TV network but also some FTTH networks). Moreover some fibre networks are also being deployed.

As the LRIC approach aims at mimicking the level of costs in a competitive and contestable market in order to send the right build/buy signals, if networks were to be re-built (as assumed in the LRIC approach), co-existence of several access networks would be highly unlikely according to DBA. The presence of several access networks in parallel owned by one single market player can indeed be considered as inefficient from a LRIC point of view, especially since they can support same types of retail services. Access networks are sometimes considered as essential infrastructures and it is therefore not desirable to duplicate such networks.

DBA however explains that the presence of several co-existing access networks is however possible during a migration phase from one technology to another.

For DBA, building the LRIC model based on co-existing access networks in the long run would lead to artificially high access costs and would give incentives to inefficient networks duplication (wrong “build or buy” signals). It should therefore be assumed that each access network topology supports 100% of the incumbent’s fixed present demand in a given area, under the LRIC principles.

According to DBA, this is in line with the European Commission Recommendation detailed above (see §3.1) which states: “*In the proposed methodology, the model includes both copper and NGA lines, and therefore only traffic volume moving to other infrastructures (e.g. cable, mobile and alternative operators' fibre) would entail an inflation of unit costs*.”

3.4.8 New entrant definition

The Model reference paper does not deal with this aspect.

3.4.9 Price control period

DBA usually sets the price control every year using yearly updates of the model and conducts more thorough reviews of the model every 2-3 years.

3.4.10 UBA specificities

DBA also applies the LRIC approach for UBA and thus all the previous findings for UCLL apply for UBA.

The full network demand of TDC (for leased lines, broadband, voice and multicast) is considered and even existing demand based on legacy networks (PSTN, SDH) is assumed to be migrated over the modelled NGN network.

With regards to allocative efficiency for assets related to bitstream, DBA recommends implementing the capacity-based allocation rule and the Shapley-Shubik based allocation rules for joint and common network costs. While the capacity-based allocation rule is the traditional rule used by regulatory authorities to allocate costs between services (voice, broadband, leased lines), the Shapley-Shubik is a game theory allocation rule which consists of setting the cost of a service equal to the average of the incremental costs of the service after reviewing every possible order of arrival of the increment. For DBA, such a rule is worth considering because it gives different insights as compared to the traditional rule (capacity-based approach). For example, with the capacity-based allocation rule, voice services are often allocated a very small share of common network costs because they use much less capacity compared to other services. Therefore, voice services may bear very low costs, which could contrast with the value of the voice services as perceived by market players and consumers. In such a case, the Shapley-Shubik allocation rule may provide a more appropriate outcome.

3.4.11 Key drivers reviewed

DBA updates its cost model on a yearly basis and the key drivers reviewed are for example related to the total network traffic, voice traffic, broadband traffic, bitstream traffic, IPTV traffic, VoD traffic, total subscriber base, data on colocation, and leased lines.

3.5 ComReg (Ireland)

3.5.1 LRIC objectives

The LRIC approach was preferred for a number of reasons including, inter alia[52]:

- the need to set the correct investment incentives to Eircom and other operators;
- the desirability of allowing only efficient costs to be recovered;
- the aim to foster competition by mandating access to the local loop on an efficient basis;
- the purpose of maximising consumer benefit: "*The method of cost recovery should be appropriate to the circumstances taking account of the need to promote efficiency and sustainable competition and maximise consumer benefits*"[53].

3.5.2 Increment definition

The increment is defined as the full local loop. However, a maximum loop length is considered for calculating the LLU maximum monthly rental charge (it is equal to 5km). An element of costs associated with these long lines above 5km, is taken into account, as there is a small probability that some lines (albeit unlikely) may be used by Other Alternative Operators (OAOs) for LLU.

Moreover, the model takes into account the fact that some lines are more likely than others to be feasible for unbundling during the price control period. LLU prices are hence calculated by giving a weighting factor to the cost of those exchange sites more likely to be unbundled by OAOs than to the cost of the other exchange sites where unbundling is unlikely to be feasible during the price control period.[54]

However, there remains one single national price for LLU since the price of LLU is derived from a national (weighted) average cost of all lines but with lower probabilities for some lines.

3.5.3 Competition objectives and 'build or buy' signals

ComReg indicates that the BU-LRIC methodology provides the correct build or buy price signal for alternative operators.

> *"The BU-LRAIC model will provide efficient incentives for alternative platform providers, Eircom and potential new entrants to appropriately invest in*

[52] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.3)

[53] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.5)

[54] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.9)

infrastructure and will ensure that Eircom recovers its efficient costs and a reasonable rate of return."[55]

Back in 2008 ComReg established a benchmark on European practices, and concluded that the bottom-up LRIC approach was especially relevant where alternative infrastructures were available. Indeed, bottom-up LRIC helps to set LLU tariffs at a relevant level[56]:

"If the level of LLU prices is very low, there is a risk that the competitiveness of these operators based on alternative infrastructures could be unfairly impacted, as would their incentives to invest in alternative technologies. In contrast, a high LLU price would deter the take-up of LLU and increase the risk of inefficient duplication of infrastructure."

Also, in an efficient market, operators should account for the future movements of prices when deciding on the timing of potential investments. ComReg therefore considered it important that regulated charges take into account this market behaviour in order to provide appropriate make/buy signals for both the SMP operator and the OAOs. This justifies the choice of a tilted annuity approach for depreciating investments.

"The application of tilts to regulated LLU prices has a similar effect, thereby providing OAOs with efficient incentives for the timing of their investments. This provides the appropriate "make" or "buy" signals for both Eircom and OAOs."[57]

3.5.4 Efficiency objectives

The relevant objective in this context is the provision of efficient investment incentives for current market players as well as those that may consider entering the market in the future.

"For these reasons, ComReg's view is that while cable represents a viable competing infrastructure to Eircom's copper access network, it is unlikely to be efficient for non-cable OAOs to employ a competing access network by means of a scorched node approach where Eircom has already deployed its network. For green field sites it may be efficient for any of the competing operators to deploy the relevant access network."[58]

[55] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.11)

[56] ComReg 08/56 – Proposals for Local Loop Unbundling Pricing Methodologies (p.9)

[57] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.27)

[58] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.42)

In fact, it is ComReg's view in its 2010 decision that the deployment of two competing access infrastructures in a given area would not normally tend to increase consumer welfare, except where there is sufficient differentiation in the technologies that the benefits of additional consumer choice outweigh the significant additional costs of having a second network.

3.5.5 Scorched-node vs scorched-earth approach

ComReg has implemented a "scorched node" approach, which, to the extent practicable and relevant, reflects Eircom's actual network topography. This ensures that the model retains an appropriate degree of realism.[59]

3.5.6 Modern equivalent asset definition

ComReg does not deal with this aspect.

3.5.7 Demand level

ComReg bases the demand on the current and forecasted demand of the incumbent operator.

ComReg does not consider that OAOs should be required to pay for the cost of lines that they would not be prepared to unbundle due to the length of lines, the presence of pair gains, poor copper connections, or other economic considerations such as economies of scale. This avoids other operators contributing to the costs of exchanges via the LLU monthly rental charge where unbundling is wholly unlikely to occur during the price control period.

3.5.8 New entrant definition

ComReg does not deal with this aspect (except for UBA, see §3.5.10).

3.5.9 Price control period

ComReg determines that the LLU price control period is three years[60]. This period allows sufficient time for the development of the LLU market, infrastructure investment by OAOs and gives Eircom the opportunity to implement efficiencies. According to

[59] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.10)

[60] ComReg - Response to Consultation Document No 08/56 (p.74)

ComReg, alternative platform providers (e.g. cable and FWA) will also be provided with a degree of certainty in relation to LLU market development[61].

3.5.10 UBA specificities

According to ComReg, implementation of minimum price floors for bitstream ("WBA") should minimise the risk of a margin squeeze in the WPNIA ("LLU") market, in accordance with Eircom's existing regulatory obligation.[62]

> *"ComReg's objective here is to encourage efficient infrastructure-based competition, and we recognise that this objective could be undermined if the relationship between the WPNIA price and the WBA price distorts incentives to invest and operate in the WPNIA market. At present, the concern is between LLU pricing and bitstream pricing. Therefore, ComReg wishes to establish a principle that will maintain an economic space between WPNIA and WBA pricing".*[63]

In ComReg's cost-plus model used to derive the indicative price floors for bitstream rentals, the new entrant is defined as a Reasonably Efficient Operator (REO) using LLU.[64] ComReg believes that OAOs availing of LLU have the best potential to offer competition to Eircom to the benefit of customers, as such OAOs, having made their efficient infrastructure investments, can offer differentiated retail products at possibly lower prices.[65]

The REO market share should be lower for lower economies of scale. ComReg considers that to use Eircom's unit costs based on a larger installed customer base would not encourage LLU Line Share based entry and therefore would not encourage appropriate infrastructure competition. This would result in OAOs remaining on bitstream to provide retail broadband products, which would reduce the potential for market differentiation and dynamic efficiency gains to the detriment of consumers.[66]

The REO has a lower market share than Eircom and unbundles a limited number of exchanges.

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[61] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.16)

[62] ComReg Doc 10/108 – Further consultation to Consultation Document No. 10/56 and draft decision in relation to price control and transparency (p.4)

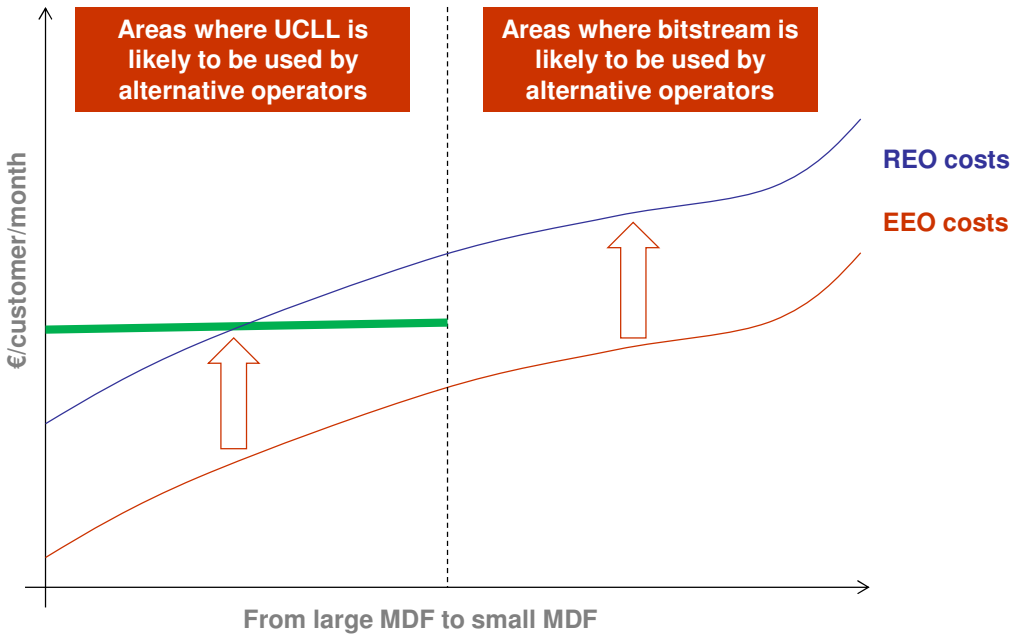
[63] ComReg Doc 10/108 – Further consultation to Consultation Document No. 10/56 and draft decision in relation to price control and transparency (p.7)

[64] ComReg - Further specification to the price control obligation and an amendment to the transparency obligation (p.25)

[65] ComReg Doc 10/108 – Further consultation to Consultation Document No. 10/56 and draft decision in relation to price control and transparency (p.6)

[66] ComReg - Further specification to the price control obligation and an amendment to the transparency obligation (p.28)

Figure 3 – Approach followed by ComReg to set UBA floors (green line represents the level of UBA price)



Source: TERA Consultants

3.5.11 Key drivers reviewed

Comreg fully updates its cost model every three to four years and as a consequence performs a thorough review of all the drivers (including WACC, number of active lines, asset lives, unit prices, price trends, etc.). It is to be noted that ComReg's decision on LLU in 2010[67] indicates that the LLU prices can be reviewed in case of exceptional circumstances which can be: significant changes in underlying costs, or price trends, or a significant change in working line volumes.

[67] ComReg Decision 01/10 – LLU and SLU maximum monthly rental charges (p.89)

3.6 BNetzA (Germany)

In 1997, Deutsche Telekom (DT) was required to provide alternative operators with Local Loop Unbundling (LLU). The German regulator at the time decided to use a "bottom-up" LRIC (or BU-LRIC) costing approach for setting rates.

The main documents available in English regarding the BNetzA approach are the comments by the European Commission[68] on the approach but also the dedicated BNetzA web page which summarizes the approach[69].

3.6.1 LRIC objectives

BNetzA wishes to calculate the costs of efficient service provision. For BNetzA, these are derived from the long run incremental costs of providing the service plus an appropriate mark up for volume-neutral common costs - both inclusive of an appropriate return on capital employed - to the extent that these costs are required to provide the service.

It is to be noted that the Telecommunications Act in conjunction with the Telecommunications Rates Regulation Ordinance of 1 October 1996 calls for rates to be based on the costs of efficient service provision, derived from the long run incremental costs of providing service plus an appropriate mark-up for non-volume-sensitive common costs[70].

3.6.2 Increment definition

For the access network, the increment should include all services that use the access network.

3.6.3 Competition objectives and 'build or buy' signals

For BNetzA promoting competition and providing the relevant 'build or buy' signal requires to assess what would be the optimal pricing level. BNetzA concludes that the interest of alternative operators does not specifically lie in low access tariffs:

- First, lower access tariffs do not – in BNetzA's view – necessarily favour the interests of the alternative operators since any such decrease on the wholesale level would be directly passed on to the retail level.

[68] European Commission, Case DE/2012/1363, Case DE/2011/1218 and Case DE/2011/1177.

[69] http://www.bundesnetzagentur.de/cln_1421/EN/Areas/Telecommunications/Companies/MarketRegulation/AnalyticalCostModel/analyticalcostmodel_node1.html#doc332782bodyText1

[70] An Analytical Cost Model for the Local Network - Consultative Document - Prepared by WIK for the Regulatory Authority for Telecommunications and Posts, 4 March 1998

- Second, having lower access tariffs is not in the interest of future NGA roll-out which will benefit to alternative operators (and consumers) in the long-run as they will be able to build their own local loop.

3.6.4 Efficiency objectives

BNetzA aims at promoting efficient investments. This is an important concept for BNetzA. Back in 1998, it was explained that:

> *"The possibility of purchasing intermediate inputs at cost-oriented prices is designed to ensure that new providers are not unreasonably hampered in their competitive opportunities through a lack of network infrastructure of their own. Where such input is not offered within a competitive framework, regulatory rulings must create a situation mimicking the workings of a competitive market. Hence costs and prices should comply with competitive criteria. This ensures that new infrastructure will only be built where services can then be provided at lower cost than on the basis of the existing network. An economically inefficient bypass of the facilities of the incumbent will be avoided. At the same time, rigorous cost orientation will guarantee that new competitors' service offers are not subsidised by the incumbent provider. Such subsidising would then also lessen the incentive for new operators to invest in their own infrastructure in cases where this promised efficiency gains, in dynamic terms at least. Cost-oriented price regulation within the meaning of this costing approach provides incentives for a regulated network operator to produce efficiently".*[71]

3.6.5 Scorched-node vs scorched-earth approach

BNetzA relies on a "scorched-node" modelling approach – i.e., it takes DT's network design as given and then adjusts the node structure, as necessary, to maximize efficiency.

3.6.6 Modern equivalent asset definition

Until 2010 the bottom-up LRIC model was based primarily on copper local access network technology which was predominant at the time. The model used a forward-looking costing approach, based on current costs, and was designed to model costs as would be incurred by an efficient operator.

In 2010, BNetzA developed an updated version of the bottom-up LRIC model which takes into account the growing use of fibre technologies (FTTx) as well as IP

[71] An Analytical Cost Model for the Local Network - Consultative Document - Prepared by WIK for the Regulatory Authority for Telecommunications and Posts, 4 March 1998

technology in the network core. The updated model is used to set charges for LLU and wholesale broadband access (as well as interconnection services).

Prices for access to the fibre loop (FttH), however, are not subject to an obligation for cost-orientation. In this case, BNetzA proposes to apply a softer price control which does not apply principles of cost orientation on the basis of the efficient provision of the service ("*Kosten effizienter Leistungserbringung*") but relies on the application of a margin squeeze test to detect potentially abusive price setting.

BNetzA is of the view that this form of price control is sufficient to ensure cost-oriented prices for fibre access. It bases this view on the assumption that, at least for the period of the current review, the copper loop will exercise a pricing constraint on the fibre loop. Due to this constraint, BNetzA considers that the stricter form of price control as proposed for copper access is not also necessary in relation to fibre access.

3.6.7 Demand level

The demand is the current and forecasted demand that DT must deliver.

3.6.8 New entrant definition

No information could be found on this aspect.

3.6.9 Price control period

The price control period is usually set for 2 to 3 years (according to the notifications history to the European Commission[72]).

3.6.10 UBA specificities

In Germany BNetzA does not enforce an effective *ex-ante* price regulation for bitstream and solely relies on an *ex-post* price control (based on a margin squeeze test).

Interestingly enough the European Commission has repeatedly stated in 2010, 2012 and 2014 that the absence of *ex-ante* price regulation for bitstream was a strong concern, but BNetzA has kept its current *ex-post* approach at this stage as it considers that there are no competition issues at stake[73].

[72] See https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal:_idcl=FormPrincipal:libraryContentList:pager&page=6&FormPrincipal_SUBMIT=1&org.apache.myfaces.trinidad.faces.STATE=DUMMY

[73] European Commission Decision concerning Case DE/2014/1566.

"*The Commission notes that BNetzA still applies an ex post approach to price controls [for bitstream], which the Commission, in* [2010] *and* [2012]*, considered as not the most appropriate and effective remedy for the market in question.*

Since NRAs are bound to take utmost account of Commission comments, the Commission reiterates [in 2014] *that the concerns which the Commission had regarding the lack of an efficient price regulation remain.*

In particular, in order to ensure regulatory certainty for access seekers and promote efficient investment by all operators, access prices would in principle need to be cost-oriented and transparent on an ex-ante basis.

In accordance with the regulatory framework, such prices can be appropriately adjusted for investment risk, in order to drive both competition and investment in (next generation) infrastructure."

3.6.11 Key drivers reviewed

As explained above, BNetzA regularly updates its BU-LRIC model. In 2013, it explained that copper LLU price should increase from 10.08 euros to 10.19 euros due to increased civil engineering costs, higher copper prices and a reduced number of copper twisted pairs (the so-called volume effect)[74].

[74] Commission decision concerning Case DE/2013/1464: Wholesale access to the copper local loop in Germany - rates for LLU, SLU, collocation at street cabinets, access to cable ducts, and dark fibre

4 Annex

4.1 Annex 1 – Other regulatory authorities relying on a TSLRIC approach

In addition to the views of six regulatory authorities (five countries and the European Commission/ BEREC), two other regulatory authorities using the LRIC approach are briefly reviewed to provide additional insights (the scarcity of the available public information makes it difficult to study these two regulatory authorities as thoroughly as the six others).

4.1.1 CMT (Spain)

The national regulatory of Spain (CMT) notified to the European Commission a draft decision with respect to UCLL and UBA prices in May 2013. This example is interesting as CMT has tried to use several methodologies in parallel and experienced practical difficulties with its bottom-up LRIC model.

The CMT developed a bottom-up LRIC model which can be run in various modes (copper/fibre overlay Point-to-Multipoint model).

For UCLL, the CMT applied the bottom-up LRIC model but considered it would be too risky to rely only on this model because this model was newly developed and needed to be improved over years. The CMT stated also that using the bottom-up LRIC model to set prices would go against principles of regulatory security and price stability. CMT considered therefore it was more prudent to use a) the results of the bottom-up LRIC b) the top-down costs and c) benchmark data. Therefore CMT moved the calculated price from €7.26 (calculated by the bottom-up LRIC model) to €8.60.

For UBA, the CMT imposed a cost orientation but subject to the requirement that there are sufficient economic incentives for the development of alternative networks. As a consequence, the CMT proposed to correct the results of the bottom-up LRIC by applying a mark-up to avoid having too low prices.

The European Commission commented that the level of the mark-up and the reasons for not using the bottom-up LRIC model only were not sufficiently justified.

4.1.2 AGCOM (Italy)

The national communications regulatory authority of Italy (AGCOM) notified to the European Commission a draft decision with respect to UCLL and UBA prices in July 2013.

The AGCOM developed a bottom-up LRIC model. It proposed:

- For LLU, to use this model;

- For SLU, to set it at 2/3 of the LLU price;
- For UBA, to add a mark-up of 3% to the bottom-up LRIC costs to secure the economic space between LLU and SLU.

As AGCOM did not explain how it calculated such a mark-up or how it calculated the ratio of 2/3 to derive the SLU price, the European Commission expressed serious doubts about this draft decision. The European Commission explained that stability of wholesale access prices is necessary to ensure sufficient and predictable revenues over time and thus to provide both SMP operators and alternative operators with sufficient incentives to invest in NGA where this would be efficient.

4.2 Annex 2 – Review of economic literature

4.2.1 Review of economic literature – Executive summary

The eight articles reviewed are:

The main findings are presented in “Table 4 – Main findings from selected economic articles”.

Table 4 – Main findings from selected economic articles

Article reference	Brito et al. (2010)	Cave (2010)	Klumpp and Su (2010)	Bender and Götz (2011)	Bourreau et al. (2011)	Nitsche and Wiethaus (2011)	Briglauer et al. (2012)	Kongaut and Bohlin (2012)
Research objectives	Can two-part tariffs promote efficient investment on next generation networks?	How the investment ladder is affected by NGAs?	Relation between dynamic efficiency, static efficiency and the setting of access charge	Analyse the effect of the access fee on investment incentives	Incentives of an incumbent and an entrant to migrate from an "old" technology to a "new" technology How the terms of wholesale access affect this migration?	How different types of access regulation to next generation networks affect investments and consumer welfare?	Relation between ex ante regulation on broadband markets and the extent of NGA deployment How does competition influence the extent of NGA deployment?	How to increase broadband penetration: the balance between competition and/or unbundling regulation?
Competition objectives and build or buy signal	Promote investment	Promote investment in NGA networks	N/A	Promote competition Provide the appropriate build or buy decision	Encourage migration to next generation networks	Investment incentive and competition intensity	Encourage NGA deployment	Regulatory holiday for a certain period of time to promote infrastructure investment.

Article reference	Brito et al. (2010)	Cave (2010)	Klumpp and Su (2010)	Bender and Götz (2011)	Bourreau et al. (2011)	Nitsche and Wiethaus (2011)	Briglauer et al. (2012)	Kongaut and Bohlin (2012)
Efficiency objectives	To solve the dynamic efficiency problem	N/A	To promote both dynamic efficiency and static allocative efficiency	N/A	N/A	N/A	Expectations on strict cost-based future NGA-related regulation outweigh potential dynamic efficiency gains	N/A

4.2.2 Review of economic literature – Key findings

4.2.2.1 Brito et al. (2010)

Brito, D., Pereira, P., & Vareda, J. (2010), "Can Two-Part Tariffs Promote Efficient Investment on Next Generation Networks?", International Journal of Industrial Organization, Vol. 28, 323-33.

The authors analyse if two-part access tariffs[75] solve the dynamic consistency problem of the regulation of next generation networks.

The article models the industry as a duopoly, where a vertically integrated incumbent and a downstream entrant, that requires access to the incumbent's network, compete on Hotelling's line. The incumbent can invest in the deployment of a next generation network that improves the quality of the retail services. Three main results are discussed in the article:

1. First, it is shown that if the regulator can commit to a policy, a regulatory moratorium may emerge as socially optimal.
2. Second, it is shown that if the regulator cannot commit to a policy, it can induce investment only when the investment cost is low.
3. Third, in this case, two-part tariffs involve very large payments from the entrant to the incumbent.

4.2.2.1 Cave (2010)

Cave, M. (2010), "Snakes and ladders: Unbundling in a next generation world", Telecommunications Policy, Vol. 34, 80-85.

According to Martin Cave, Next Generation Access (NGA) networks are an opportunity and a challenge for regulators. Unlike the costs of a copper access networks, those of an NGA are not yet sunk; hence fixed monopoly suppliers need an incentive to invest. This need is likely to influence the regulator's unbundling and access pricing regime, including application of the 'ladder of investment', which encourages competitors to develop their own infrastructure.

This paper considers whether the principles governing the operation of the ladder of investment can be directly applied to next generation access networks. It is argued that an equivalent ladder of investment exists with NGAs and that regulators can use their powers to nudge operators upwards. There are however, important differences:

[75] Tariff that includes two distinct components: a one-time access fee that the consumers pay for the right to buy a product, and a per-unit price for each unit they consume.

- whereas the costs of the copper network were sunk a long time ago, NGAs in most countries are still in the course of construction; unless large scale duct-sharing is attainable, the regulator is thus confronted by an apparently intractable conflict between promoting competition on the network and creating incentives to build it in the first place;
- the disappearance of the unbundled local loop on the current generation ladder forces operators closer to or further away from the customer as they switch to the fibre network; it is suggested that an ability to move closer depends on a variety of contingent circumstances relating, for example, to the state of ducts, prevalence of multi-dwelling housing or housing density;
- closing down the copper network is a significant objective, and this makes access prices on both networks interdependent – there is a case for regulators to increase the price of copper access products to speed up migration.

4.2.2.2 Klumpp and Su (2010)

Klumpp, T. & Su, X. (2010), "Open Access and Dynamic Efficiency", American Economic Journal: Microeconomics, Vol. 2(2), 64-96.

The authors consider a model in which production of a downstream good requires access to an excludable upstream resource owned by a vertically integrated firm. The quality of the resource depends on an investment made by the owner and impacts the demand curve in the downstream market. Under open access, the owner must share the resource with downstream competitors at a regulated tariff, determined after the investment is made.

The study shows that the owner's investment exceeds the monopoly level if the access tariff is set according to a principle that can be called "revenue neutrality". This (complex) principle "*prescribes a linear access tariff, chosen after the investment is made and before the downstream outputs are chosen, with the following property: Ex-post, the firms will have paid for the upstream investment in proportion to their downstream market shares.*" (The implementation of such approach is not detailed).

Revenue-neutral open access is consistent with current open access laws and requires only limited information on part of the regulator. Furthermore, quality increases with the number of entrants in the downstream market. The results hence contradict the notion[76] that dynamic efficiency must be sacrificed for gains in static (allocative) efficiency.

The intuition behind this result is the following. Because quality shifts the demand curve outward, the effect of an additional quality unit on the industry's revenue is larger, the

[76] This notion, known as the efficiency trade-off, stems from the observation that while open access at the wholesale level facilitates competition in the downstream market, requiring a firm to share its physical or intellectual resources with competitors may reduce the firm's incentive to invest in them in the first place. The welfare gain from increased competition in the downstream market may thus be offset by a degradation of upstream resources (or wholesale inputs). Put differently, an open access policy that increases static efficiency can have adverse effects on dynamic efficiency.

larger the output in the downstream market. One way to increase output is to let many firms participate in the downstream market, which is precisely what an open access policy does. On the other hand, the effect of an additional quality unit on the industry's fixed cost is independent of the downstream output. If costs are now shared in the same proportion as revenues, this industry-wide effect is internalized: a more competitive downstream market raises the incumbent's private return to the investment relative to its marginal cost, thus leading to stronger incentives to invest in quality.

4.2.2.3 Bender and Götz (2011)

Bender, C. & Götz, G. (2011), Coexistence of Service- and Facility-Based Competition: The Relevance of Access Prices for Make-or-Buy-Decisions, MAGKS Discussion Paper No. 07.

This paper models competition between two firms, which provide broadband Internet access in regional markets with different population densities. The firms, an incumbent and an entrant, differ in two ways.

1. First, consumers bear costs when switching to the entrant.
2. Second, the entrant faces a make-or-buy decision in each region and can choose between service-based and facility-based entry.

The usual trade-off between static and dynamic efficiency does not apply in the sense that higher access fees might yield both lower retail prices and higher total coverage. This holds despite a strategic effect in the entrant's investment decision. While investment lowers marginal costs in regions with facility-based entry, it intensifies competition in all regions. The paper shows that the cost-reducing potential of investments dominates the strategic effects: higher access fees increase facility-based competition, decrease retail prices and increase total demand.

Concretely, it shows that the entrant's investment decision includes a trade-off:

- On the one hand, investment yields cost savings in regions with facility-based entry and enables the entrant to attract more consumers with lower prices.
- On the other hand, as the entrant becomes more aggressive, the incumbent becomes more aggressive, too, and retail competition is fostered in all covered regions.

The entrant will take the competition effect of its investments into account and, therefore, act strategically. Hence, it is not sufficient that investment yields average costs below the access fee in a specific region to trigger facility-based competition.

4.2.2.4 Bourreau et al. (2011)

Bourreau, M., Cambini, C., Dogan, P. (2011), Incentives to migrate to next generation networks: From "old" to "new" technology", Working Paper.

This paper analyses the incentives of an incumbent and an entrant to migrate from an “old” technology to a “new” technology, and discusses how the terms of wholesale access affect this migration. It shows that a higher access charge on the legacy network pushes the entrant firm to invest more, but has an ambiguous effect on the incumbent’s investments, due to two conflicting effects:

1. The wholesale revenue effect: if the incumbent invests in a higher quality network, the entrant will invest in reaction, and the incumbent will then lose some wholesale profits; and
2. The business migration effect: when the access price of the legacy network is low, the prices for the services which rely on this network are low, hence, in order to encourage customers to switch from the old network to the new network, operators should also offer low prices. This effect reduces the profitability of the new technology infrastructure, and hence the incentives to invest in it.

If both the old and the new infrastructures are subject to ex-ante access regulation, the two access charges are positively correlated.

4.2.2.5 Nitsche and Wiethaus (2011)

Nitsche, R., Wiethaus, L. (2011), Access regulation and investment in next generation networks – A ranking of regulatory regimes, International Journal of Industrial Organization, Vol. 29, 263272.

This paper analyses how different types of access regulation to next generation networks affect investments and consumer welfare.

The model consists of an investment stage with uncertain returns and subsequent quantity competition. The access price is a function of investment costs and the regulatory regime. The paper considers four possible regimes:

1 **Long Run Incremental Cost (LRIC):** The aim of LRIC regulation is to mimic competition. The incumbent may recoup investment costs through the access price as long as the asset reflects the most efficient technology in providing the service. NGN will be considered an efficient technology if the majority of consumers value NGN-based services; otherwise the copper network is (or would be) the cheapest way to provide old services (an alternative interpretation is that, if there is no demand for NGN applications, the entrant continues to purchase cheaper access on the basis of the copper technology).

2 **Fully distributed costs regulation (FDC):** under this regime the incumbent may recoup NGN investment costs through the access price, regardless of the NGN's market success. The entrant is forced to cover part of the investment costs, thereby reducing the potential downside for the incumbent.

3 **Risk-sharing:** telecom operators jointly (cooperatively) deploy and share the costs of NGN. Each operator may use the NGN for a new NGN customer without any further access payment.

4 **Regulatory holiday[77]:** the incumbent is not forced to give access to its NGN and it can set the access price without regulatory oversight (at least for a certain period). The paper derives the access price thanks to a Nash bargaining between the incumbent and the entrant.

The results can be broken down into three layers:

i. competitive intensity *for given investment levels*;
ii. investment levels and
iii. consumer surplus (combining (i) and (ii)).

The main results of the paper are threefold:

a. First, for any given investment level, the paper shows that risk-sharing is expected to induce highest competitive intensity in the product market. It can also be shown that LRIC induces higher competitive intensity than FDC.
b. Second, under uncertainty, FDC or regulatory holiday induce the highest investments, followed by risk-sharing and LRIC, respectively.
c. Third, simulation analyses indicate that risk-sharing induces the highest consumer surplus. This result occurs due to a combination of strong *ex-post* competitive intensity and yet reasonable investment incentives. FDC, regulatory holiday and LRIC generate the second, third and least desirable outcome for consumers, respectively.

The paper concludes that a critical question open for future research is how to set access conditions (if any) for (late) entrants that do not participate in a risk-sharing agreement. In this context the authors advocate that:

- a risk-sharing consortium should allow many interested parties to get on board *ex-ante*,
- whereas an overly favourable *ex-post* access obligation should not jeopardise the very idea of risk-sharing.

4.2.2.6 Briglauer et al. (2012)

Briglauer, W., Ecker, G., and Gugler, K. (2012), Regulation and Investment in Next Generation Access Networks: Recent Evidence from the European Member States. Working Papers, Research Institute for Regulatory Economics, WU Vienna University of Economics and Business, Vienna.

[77] According to Vogelsan: "*Regulatory holidays mean that regulation only begins with a lag after conditions for regulation (the regulatory requirement) have been met.*" (Vogelsang, Incentive Regulation, Investments and Technological Change, 2010)

This study identifies the most important determinants of NGA deployment, using data from the EU27 member states for the years 2005 to 2010.

The results indicate that stricter broadband access regulation has a negative impact on NGA deployment, while competitive pressure from broadband and mobile affects NGA deployment in an inverted U-shaped manner. The authors further find that there are severe adjustment costs and stickiness towards the desired long-term level of NGA infrastructure. It appears that the approach of the European Commission of strict cost-based access regulation will not elicit the huge new investment needed for a comprehensive NGA roll-out, mainly for two reasons:

1. Operators based their investment decision on past regulatory frameworks, which were considered as heavy-handed and may have led to lower levels of NGA deployment;
2. Even if regulators have adopted a lighter approached, the level of NGA deployment seems resistant to change (stickiness).

Finally, based on the empirical analysis, it appears that the expectations on strict cost-based future NGA-related regulation outweigh potential dynamic efficiency gains via service-based competition as stipulated by the ladder of investment hypothesis.

4.2.2.7 Kongaut and Bohlin (2012)

Kongaut, C., Bohlin, E. (2012): An empirical study of unbundling regulation on broadband adoption in OECD countries: What can we learn for future regulation?, 19th ITS Biennial Conference 2012, Bangkok, Thailand, 18 - 21 November 2012: Moving Forward with Future Technologies: Opening a Platform for All.

This paper aims to analyse the impacts of unbundling policy on various aspects of broadband adoption that can be presented as consumer welfare, among which it was shown that:

- Countries with LLU regulation generally have greater broadband penetration compared with countries without LLU regulation
- Lowering the wholesale unbundling price leads to higher broad band adoption
- Unbundling policy can be useful for increasing broadband penetration especially when one technology is dominant, while at a later stage, platform competition becomes one of the main drivers of broadband adoption.

The possible adaptation to NGA regulation is also discussed in this paper. The decision to apply access regulation from DSL to fibre technology is therefore crucial to whether the regulator regulates the NGN market from the early stage of investment or waits for the NGN market to become more mature. Alternatively, the regulator can opt not to intervene in the market for a certain period of time, as access regulation can delay the growth in infrastructure investment.