WIK-Consult • Report

Study for Enable Networks and Ultrafast Fibre

EOI pricing for unbundled services of LFCs

Public Version

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Executive Summary

1. WIK-Consult has been approached and commissioned by Enable Networks and Ultrafast Fibre to advise them on their future pricing approach regarding unbundled L1 services and how to meet the equivalence requirement. In conducting this report we had intensive workshops with management and experts of the two LFCs to discuss network structures, services, business plans and the costs of the networks. Furthermore, we had extensive discussions with Dr Ross Patterson, the legal advisor of the LFCs.

2. On the basis of the production structure of the L1 unbundled service and the following cost structure we develop a proposal for a pricing approach which meets the equivalence requirement. Our proposal is cost-based pricing based on top-down costing, and we also present the principles for applying that costing approach. Furthermore we show that pricing based on bottom-up costing and prices derived from margin squeeze considerations are inappropriate pricing approaches to meet the equivalence requirement given the institutional and market environment in New Zealand. In the Annex to the paper we summarise and assess the costing approaches which the LFCs have developed to determine their EOI prices.

3. The LFCs have built their networks such that the L1 network (and the elements of that network, transparently and separately identifiable) is an input to producing the L2 service for the RSPs as well as for producing the L2 service by the LFCs. To produce L2 bitstream the LFCs have added only two active network elements to the passive L1 network: The OLT at the Central Office and the ONT at the end-user premises. The only L1 network element which has to be duplicated when an access seeker requires an unbundled L1 service, is the splitter in the FFP; the access seeker provides its own OLT and ONT. All other network elements of the L1 network are shared between the LFC and the access seeker. Thus, from a network and service point of view access seekers will get access to the LFC's network such that their access is equivalent to the LFC's own access or usage of the network.

4. What does equivalence in terms of pricing mean or require? The proper reference model for equivalence in wholesale pricing is that there is only one uniform price for using the L1 passive network that is charged in the same way to access seekers and to the LFCs themselves internally. What would be the (virtual) internal transfer price which an LFC would charge its (virtual) business units which produce at the higher end of the wholesale value chain L2 bitstream services? As the L1 unbundled service is an universal input service for all services the LFCs provide, only a cost-based price is consistent with efficiency and proper incentives for investment and maintaining the network in best quality over the long period of its use and for using the network efficiently. Furthermore, only cost-based pricing guarantees economic recovery of the initial investment made for building the network.

5. The most relevant costing approach to determine the price of a service which is equivalent to actual costs is a top-down costing methodology.

6. LFCs face in their use of the Layer 1 network a cost structure which is directly related to two separate product (and therefore price) components. The unbundlers would cause the same cost of service. Any deviation of that cost structure would cause distortions, inefficiencies and would burden the LFCs with a significant risk. EOI requires two separate price components for the Layer 1 service: The feeder component and the distribution component.

7. Bottom-up costing is an unsuitable approach for the fibre market in New Zealand because its inherent requirements of modelling a Modern Equivalent Asset are different to the network and institutional environment of the LFCs. LFCs have not been able to take major network related business decisions on their own efficiency and profitability considerations. It does not make sense to model a (potentially) more efficient network structure when LFCs were obliged by the Government via CIP to build their networks in exactly the form as they did. Nevertheless, LFCs operate in a competitive market which incentives them to operate efficiently in those areas of the cost structure which they had and have under their control. Furthermore, they became partners of the Government in the UFB initiative in a competitive bidding process which also incentives them to build their network in those elements which were under their control efficiently.

8. Several interested parties have proposed to derive the L1 EOI price from an economic replicability test (ERT). The key focus of an ERT is the difference between the upstream L1 and the downstream L2 price. Application of the ERT concept leads to efficient pricing where the L2 price is efficient: that is cost based or competitively set. That is not the case in New Zealand, where prices were set in 2011 under contracts with CIP. If the downstream service price (the L2 price in our context) is not efficient then the resulting upstream price (the L1 price in our context) resulting from applying the ERT methodology would not be efficient either. Or to put it in other terms: if the L2 price is not cost-based then the L1 price resulting from the ERT methodology would also not be cost-based. If the L2 price is below cost a loss then also the resulting L1 price would generate a loss. The L2 price in New Zealand is not the result of economic efficiency considerations. Instead, it is significantly distorted and does not cover cost. Thus, our conclusion is that the current Layer 2 price cannot be the reference point for determining the L1 price following an economic replicability consideration.

1 Introduction

9. From 1 January 2020 onwards the fibre market in New Zealand will face major changes. From that date onwards the Local Fibre Companies ("LFCs") which have built and operate the fibre networks have to provide unbundled access services on their network. So far they mainly provide a Layer 2 bitstream service. The unbundled service will become the universal input service for all services the LFCs provide.

10. LFCs will have to provide unbundled services under an equivalence obligation or requirement. The Telecommunications Act ("the Act") only provides a rather general definition and description of what equivalence would or should mean in providing the regulated services.

11. WIK-Consult has therefore been approached and commissioned by two LFCs (Enable Networks Limited and Ultrafast Fibre Limited) to advise them on their future pricing approach regarding L1 services and how to meet the equivalence requirement. Enable Networks and Ultrafast Fibre are the companies responsible for the construction of the Ultrafast Broadband ("UFB") fibre-to-the-premises network in Christchurch/Rolleston/Rangiora, and Tauranga/Hamilton/Tokoroa/New Plymouth/Hawera/ Whanganui respectively. Their initial UFB areas accounted for 15.3%, and 13.7% respectively of the national UFB network, with Chorus responsible for 69.4% and Northpower Fibre the remaining 1.6%.

12. Following some initial fact findings and the analysis of various options for equivalence of input pricing we had intensive workshops with management and experts of the two LFCs in the second week of April to discuss network structures, services, business plans and the costs of the networks. Furthermore, we had intensive discussions with Dr Ross Patterson, the legal advisor of the LFCs, on the legal requirements which had been imposed to the LFCs as part of their requirements to build the fibre network. All these discussions had been a valuable input to this report.

13. This report is structured as follows: In Section 2 we present the legal, institutional and regulatory environment of the fibre market in New Zealand. In Section 3 we develop our proposal for a proper EOI pricing approach and shortly address non-price aspects of the equivalence of input concept. In Section 4 we will deal with two approaches which have been proposed as tools to calculate EOI prices and which we regard as inappropriate, namely bottom-up cost modelling and applying an economic replicability test.

2 The institutional, legal and regulatory framework

14. At the beginning and before reflecting and assessing the legal and regulatory framework of the LFCs, it is important to develop a clear view on the environment, constraints and requirements under which the LFCs had to build their fibre networks.

15. Fibre networks in New Zealand are built as part of the Ultra-Fast Broadband ("UFB") initiative. The UFB initiative was launched by the Government in 2009 with the intention to cover 75% of the population with fibre access within 10 years (i.e. by 2020). The Government provided partial funding at the amount of $ 1.3 billion. The Government established Crown Infrastructure Partners Limited ("CIP") to manage its investment in UFB fibre networks.

16. The Government/CIP selected four private partners in a tendering process to deploy the fibre networks. The structurally separated Chorus received the majority of the deployment contracts. The other three partners set up new companies that built smaller regionally-based networks. Different to Chorus they do not operate copper networks.

17. In January and August 2017 the Government made new agreements with Chorus and the other LFCs to extend the fibre coverage in New Zealand from 75.4% to 87% ("UFB2"). For the UFB2 initiative the Government provided an additional funding of $ 437 million. UFB2 is expected to be completed by the end of 2022, and is not required to be unbundled until 1 July 2026.

18. The organisational model of the UFB initiative required Chorus and the other LFCs to operate on a non-discriminatory wholesale-only model. LFCs are prohibited to offer end-user services or wholesale services above Layer 2 but have to supply only fibre access services to retail service providers ("RSPs"), which then sell retail services to end-users based on these fibre inputs. Instead, the LFCs are required to supply Layer 1 and Layer 2 fibre access on a wholesale basis.

19. Based on the amendments to the Act in 2011 Chorus and the other LFCs entered into deeds of open access undertakings with the Crown. Network structure, service provision and wholesale prices, furthermore, were fixed in commercial agreements which Chorus and the other LFCs concluded with CIP. These agreements rather comprehensively governed and fixed architectural structure and the commercial provision of network services. The conditions and requirements included:[1]

    - price caps for specified services;

1 See Commerce Commission (2018), p. 19.

- financial funding through a public-private partnership model;
- sharing of upside and downside risk, such as risk during the build phase and demand risk;
- lines of business restrictions;
- commercial, operational and technical requirements for providing unbundled Layer 1 services from January 2020;
- expectations around the timing of the network build, and
- expectations for the service levels to be provided to RSPs and by implication to end-users.

20. Regarding network structure/architecture and service provision CIP made inter alia the following requirements:[2]

    (1) The point to multipoint network has to support the Layer 1 requirements of GPON.

    (2) The network and splitter ratios shall support a minimum connection speed of 100 Mbps downstream and 50 Mbps upstream[3].

    (3) The access network and specified Layer 1 service is designed and built to support future growth via an upgrade path to speeds at least 10 times those specified under (2).

    (4) The provisioning of fibre in the network shall allow for sufficient fibre to permit future Layer 1 unbundling post 31 December 2019 with

        - two fibres per premises where a P2P architecture is chosen;
        - sufficient feeder and distribution fibres, where a P2MP architecture is chosen such that each premise may be served by two distribution fibres fed from separate splitters, the second splitter to be provided by an access seeker; and
        - sufficient fibre to allow for growth and in-fill housing.

2 Annexure 2, Network Infrastructure Project Agreement between CIP and LFCs.
3 This allows a splitting ratio of up to 1:25 (with standard GPON: 2,500 Mbps down and 1,250 Mbps upstream). For operational reasons some operators use instead a splitting factor of 1:24.

(5) The provisioning of both feeder and distribution fibre allows for forecast infill development for the provision of P2P services to priority users as well as for redundancy and fault preventing.

(6) The Central Office(s) shall provide accommodation and facilities for P2P Layer 1 access seekers.

(7) In the event that the street cabinets or fibre flexibility points do not accommodate access seeker P2MP splitters that they will provide for a tie cable from the cabinet or fibre flexibility point to the access seeker's cabinets/fibre flexibility points.

(8) The network shall support an RF overlay solution for the delivery of TV broadcast services over fibre.

(9) No Central Office may service more than 50,000 premises passings.

21. It is important to note that CIP fixed the wholesale price caps which the LFCs can charge. All (contractually regulated) prices were determined until 1.1.2020 when the Commission was assumed to set up a new regulatory regime for fibre (pricing). This timing has been extended to 1.1.2022, and the contracted prices remain in place (subject to CPI adjustment) until 2022. It is important to note that all LFCs have the same wholesale price caps as determined by CIP regardless of their cost of deploying the fibre networks in their respective coverage areas.

22. Right from the beginning of their operations in 2011 the LFCs have been subject to an information disclosure requirement.[4] The information disclosure requirement is based on Section 156AT of the Act. Inter alia the Commission requested the following information:

- Expenditure on building the UFB networks;
- Revenue earned;
- Operating costs from supplying services;
- Progress on the roll-out;
- Details about the assets deployed.

23. According to Section 156AD(2) of the Act LFCs were required to enter into undertakings to supply unbundled Layer 1 service on all parts of their fibre networks after 1 January 2020. LFCs, furthermore, have to achieve equivalence in relation to the supply of those services.

4 See Commerce Commission (2018), p. 23f.

24. The equivalence requirement means according to the Act[5] "*equivalence of supply of the service and access to LFC's network so that third party access seekers (RSPs) are treated in the same way to LFC's own business operations, including in relation to pricing, procedures, operational support, supply of information and other relevant matters*". This equivalence of input (EOI) requirement is the only requirement, LFCs have to meet when providing the unbundled services. Agreement on service description and price with RSPs or the Commission is not required by the Act.

25. The undertakings which the LFCs have concluded in the Deed of Open Access with the Crown are enforceable by the Commission and require all input services to meet the equivalence standard. The undertakings define the following input services to be provided from 1 January 2020:

    (1) a point-to-point Layer 1 access service – the Direct Fibre Access Service ("DFAS");

    (2) a point-to-multipoint Layer 1 fibre access service – the PON Fibre Access Service ("PONFAS");

    (3) a Central Office and POI Colocation service.

    The obligation to supply DFAS and PONFAS on an EOI basis only extends to services provided to the premises and does not extend to non-building access points, e.g. cell towers or street lights. Services to non-building access points may be provided on a commercial basis.

26. The requirements within the undertakings provide some further specification of the equivalence of input requirement in non-price terms:

    (1) LFCs have to design and build their networks to ensure that by 1 January 2020:

        - there is sufficient space in ducts (or additional dark fibre) to enable EOI; and

        - the LFC's operational and business support systems (OSS and BSS) are capable of supporting EOI.

    (2) The LFC will provide all O&M Services directly related to the provision of Layer 1 services to access seekers on an EOI basis from 1 January 2020.

5 Section 156AB Telecommunications Act 2001.

27. The equivalence requirement of the Act is not impacted by the new regulatory framework for fibre in Part 6 of the Act for which the Commission is currently developing input methodologies.[6] Under the new regulatory regime for fibre fixed line access services ("FFLAS") price-quality regulation is likely to be applied to Chorus and an information disclosure regime is likely to be applied to Chorus and the other LFCs, both based on the Commission's input methodologies. The new FFLAS regime will come into effect from the beginning of 2022.

28. The new Part 6 of the amended Act will introduce a form of utility-style regulation. Price-quality regulation in this regime is usually based on a building blocks model ("BBM"). The BBM approach is used to calculate the maximum allowable revenue (or prices) based on delivering the regulated services over the regulatory period. The BBM approach may also become relevant for the other LFCs although they will not be subject to price-quality regulation. The Commission may use the BBM as an element of the information disclosure regulation of the other LFCs to access their profitability.[7] We do not go into the details of the BBM because that regime is not relevant for the equivalence requirement.

6 See Commerce Commission (2018).
7 See Commerce Commission (2018).

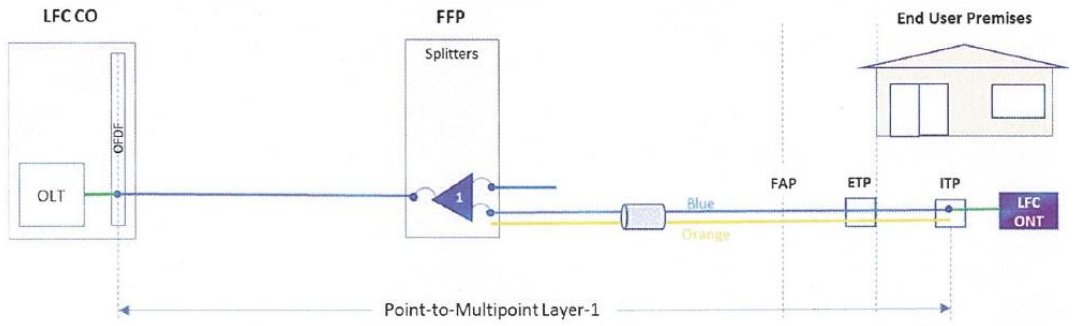
3 The proper EOI pricing approach: Internal transfer prices derived from top down costing

3.1 The L1/L2 relationship

29. To have a proper starting point for equivalence pricing it is essential to have a clear view on the LFCs' network architecture, to recognize how the unbundled L1 service is produced and how it is related to the L2 bitstream service.

30. Figure 3-1 describes the network elements of the existing networks deployed by each LFC. The Layer 1 service in the represented P2MP architecture extends from the optical fibre distribution frames ("OFDF") in the Central Office ("CO") over the fibre feeder cable (from the OFDF) to the FFP. Here the splitters are located which are connected to a feeder fibre in the network sided direction and offer ports for end customer connections. These ports are connected to a distribution frame when an end premises is connected. The end customer fibre cables can be patched onto such splitter customer sided port with a pigtail according to the provider it has contracted.

Figure 3-1: Existing PON Network Architecture – Underground (ALL LFCs)



Source: LFCs (2018), p.5

At the splitters in the FFPs the distribution fibre cable for each end-user premises ends and extends on its other end to the Internal Termination Point ("ITP"). The ITP is the fibre network demarcation and test point within the customer's building and it is marking the end of the LFC's P2MP Layer 1 network. The Fibre Access point at the border of the property ("FAP") and the External Termination Point ("ETP") outside the building are intermediate construction elements used for ending fibre construction when a building is not yet contracted for being connected to the network and using its services. The FAP can be hosted in a handhole or a distribution box at the edge of the street (or on a pole), the ETP usually is mounted on the external

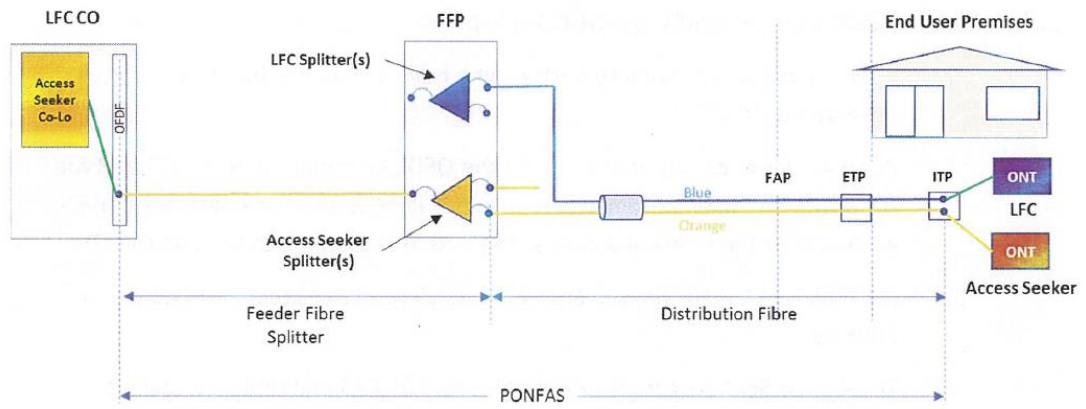
wall of residential and most commercial single dwelling units. They are also part of the distribution network. The LFCs have to install two fibres to each home (blue and orange line). While the blue line is used for providing the bitstream access service by the LFC, the orange line is dedicated for fibre unbundling. By this a building can be served by two active networks in parallel, one over the LFC's bitstream and one over its unbundling service, thus providing a wider choice of services to the end customer. The P2P DFAS service uses the same network elements as the P2MP L1 network with the exemption of the splitters. So it is using the blue/orange distribution fibre and a fibre of the feeder network segment. Both are connected to each other by a patch cord (or direct splice) in the FFP. This network architecture has been requested and approved by CIP in each LFC's respective Network Infrastructure Project Agreement.

31. For providing the L2 bitstream wholesale services over their P2MP fibre topology, the LFCs have installed two active network elements to the passive L1 network elements: The OLT (Optical Line Terminator) at the Central Office and the ONT (Optical Network Terminator) at the end-user premises. Both elements are required to administer the competing access requirements of the end-users connected to the same splitter and the same single and thus shared feeder fibre line towards the Central Office.

32. Figure 3-1 shows that the L1 network and the elements of that network transparently and separately identifiable is an input to producing the L2 service for the RSPs as well as for producing the L2 service by the LFCs.

33. Figure 3-2 shows the structure of the network when an access seeker requires an unbundled Layer 1 service. The only network element which has to be duplicated in this case is the access seekers splitter(s) in the FFP to which the distribution fibres of its customers are connected. All other network elements of the Layer 1 network are shared between the LFC and the access seeker. In particular, the FFP and the feeder fibre have to be dimensioned to meet all relevant access demand.

Figure 3-2: Unbundling in the PONFAS Architecture – Underground (All LFCs)



Source: LFCs (2018), p.7

34. When the RSP produces its own bitstream L2 service based on the unbundled L1 service, it has to install its own OLT equipment collocated at the LFC's CO and its own ONT at the end-user premises. Furthermore, a separate splitter is provided by the LFC which corresponds to its service specification.

35. This analysis shows two essential features of the system: (1) The L1 network and the corresponding L1 unbundled service is an input service to produce the L2 service. (2) Under the architectural model described access seekers which require the Layer 1 unbundled service get access to the L1 network in the same way as the LFCs get it to produce their own L2 services. Or to put it into other terms: Under the intended PONFAS service description and service provision access seekers get access to the LFC's network such that their access is equivalent to the LFC's own access or usage of the network.[8]

3.2 Cost-based pricing

36. When access seekers and the internal operations of the LFCs face equivalence in the L1 service they are using, what does equivalence in terms of pricing mean or require? Which pricing rule is coherent with non-discrimination of the own use of the L1 network by LFCs and the use of the same network (elements) for the L1 unbundled service by RSPs?

8 A RSP could also base its bitstream service on DFAS only, i.e. providing a high quality L2 bitstream service for business customers. This also uses the components of the passive LFC infrastructure, including the feeders but without the GPON active network components.

37. The proper reference model for equivalence in wholesale pricing is that there is only one uniform price for using the L1 passive network to be charged in the same way to access seekers and to the LFCs themselves internally. If the LFCs were organisationally structured and separated in separate units like the L1 network unit, the L2 service unit, any other unregulated service unit(s), then the L2 service and the other units would order, demand and pay the unbundled L1 service indirectly in the same way as access seekers. Although the LFCs – for good reasons – were not required to (further) structurally separate, the reference model of separation is nevertheless useful for EOI pricing. The principle of a uniform unbundled Layer 1 price then would mean that the virtual L1 network unit will sell the Layer 1 service internally or to the virtual L2 business unit as an internal transfer price. This virtual transfer price is equal to the price the LFC charges the RSPs for the unbundled L1 service. In case of the LFC this (equivalent) transfer price would be a cost input for calculating the L2 wholesale price in addition to the L2 service-specific network elements and costs.

38. What would be the (virtual) internal transfer price which an LFC would charge its (virtual) business units which produce at the higher end of the wholesale value chain L2 bitstream and unregulated services? Given the nature of the L1 unbundled service as an universal input service for all services the LFCs provide, only a cost-based price is in line with efficiency and proper incentives for investment and maintaining the network in best quality over the long period of its use and for using the network efficiently. Furthermore, only cost-based pricing guarantees economic recovery of the initial investment made for building the network.

39. Cost-based pricing means that the network operator can recover all costs which occur in building and operating the network. This includes a proper return *on* capital, a proper return *of* capital, operating expenditure and a properly allocated share of common costs. Return *of* capital is represented by the depreciation of the relevant assets. The return *on* capital is represented by the WACC covering the relevant cost of capital (debt and equity). The WACC, if properly determined, delivers a proper market-based return on equity (or profit) and a proper compensation for the risk of the infrastructure fibre business.

3.3 The top-down approach

40. How to determine cost-based prices? Under their legal constraints LFCs have to cover their actual cost for providing the services.[9] The most relevant costing approach to determine the price of a service which is equivalent to actual costs is a top-down costing methodology.

9 See Section 176 (2AA) of the Act and Commerce Commission (2018), p. 97f.

41. First of all, products or product components have to be determined such that costs can be allocated to the relevant products. Because the Layer 1 fibre network produces the DFAS and the PONFAS service, the fibre access network has to be separated into the feeder component which covers the fibre from the fibre distribution frame in the CO to the ODF (or splitter in the case of P2MP) inside the FFP and the distribution component which is the fibre from the splitter to the end-user ITP. The feeder service comprises an LFC-supplied splitter located at an FFP and a single feeder fiber from the splitter to the OFDF at the CO. The distribution service comprises a single fibre from the connector from the ITP at the end-user premises to a port on a splitter in the FFP. The cost of the central office(s) have to be allocated between the co-location and the L1 unbundling service.

42. This separation of product components as defined in para. 41 exactly reflects the cost structure of the unbundling service in a P2MP (or P2P excluding the splitter) topology of the fibre network. The LFCs have to install one splitter for the first one, two or three customers of an RSP and they have to provide space in the cabinet for the additional splitter. Furthermore, each splitter uses one feeder fibre independent of how many customers are connected to the particular splitter. An aggregated price structure would burden the LFCs with potentially significant costs of unused and unpaid capacity if one would set the pricing on a per connection charge only. This would also generate incentives for an inefficient use of the LFC's capacity on the side of the RSPs. To sum up: LFCs face in their use of the Layer 1 network a cost structure which is directly related to two separate product (and therefore price) components. The unbundlers would cause the same cost of service. Any deviation of the cost structure from the price structure would cause distortions, inefficiencies and would burden the LFCs with a significant risk. Thus, there is no conflict to EOI. At the opposite, EOI requires two separate price components for the Layer 1 service.

43. Besides recurring rental charges for the use of the feeder fibre and the fibre distribution component one-off costs for transaction services will occur. Transactional charges that occur during the first time deployment of the services are allocated to the total cost of the service. But when end-customers move between RSPs which are both based on an unbundled access service, so that the end-customer's distribution fibre has to be switched from one RSP's splitter to another RSP's splitter this induces operational cost for the field service to change the splitter pigtail at the FFP to the new splitter. Such effort is only caused by the end-customer's provider change and is not part of the unbundling service itself. Another typical example of transactional field service effort is the unjustified call for failure support when the failure is caused by the RSP's equipment (i.e. the ONT) or by the end customer. Transaction services basically cause operating expenditure. Thus, operating expenditure have to be allocated between the Layer 1 network operation costs and the costs for transactional services.

44. The investment cost of deploying fibre networks are strongly driven by access line density within the network coverage area. We have shown that in the case of Germany (and many other countries) with a geo-modelled investment cost model for a nationwide fibre network. In that model we have clustered all MDF areas on the basis of access line density within each of the about 8,000 MDF areas in Germany. We distinguished 20 cluster from more than 2,750 lines per km^2 per MDF area to less than 1 line per km^2. Each cluster represents about 2 million access lines. Figure A - 1 in the annex demonstrates this clustering approach geographically. Table A - 1 exhibits the results. In the highest density cluster 1 an investment of 1,440 € per fibre access line is necessary to build a P2P FTTH network at a 70% penetration rate. In the lowest density cluster 20 the investment cost nearly triple to 4,310 €.

45. Although we are not aware of a similar model-based calculation for New Zealand, we know from the UCLL cost modelling exercise of the Commission[10] that investment cost also vary significantly by density in New Zealand. Although the individual UFB1 networks allocated to an LFC will exhibit relevant differences in density, we assume that each LFC will charge a uniform access price for all networks of its coverage area although costs may differ within an LFC area. This assumption implies that costs are identified and allocated at each LFC level and therefore averaged over all UFB1 networks within the coverage area of an LFC.

46. The top-down model has to be capable of determining the full cost of the feeder fibre and the distribution fibre product component for both the PONFAS and the DFAS service. The model may also be designed to represent the costs of other services (like the L2 service or transactional services) which share assets or costs with the regulated L1 services. These other services should be included in the calculations insofar as they share costs with the L1 services but their full asset base or costs should not be represented and therefore their total costs would not be captured.

47. The LFCs have fully deployed their UFB1 networks. Thus, their actual cost are basically determined by a 100% network coverage, even though up-take is below this level. According to their roll-out concept the initial network build includes the ducts of the distribution segment of the access network up to the roadside boundary of each building. If an end-user wants to be connected to the fibre network, the LFC provides, for an underground connection, the duct connection between the roadside boundary and the building, the ITP within the building, blows-in the fibre from the FFP to the ITP and connects the fibre to the splitter. These three components of the connection investment is a variable investment which is customer driven. All other investment is fixed and just driven by the coverage of the network. Demand is

10 See Commerce Commission (2015).

different to coverage. The UFB uptake amounted to 50% on an New Zealand average by December 2018.[11] This represents actual demand. Because the LFCs did not have any choice to adapt network coverage to demand but were obliged to manage definitive roll-out targets, the actual demand represented by the number of active connections has to bear the cost of the fully build L1 network if LFCs are to cover their actual costs.

48. As the model has to calculate the cost of service from 1 January 2020 onwards, assets, costs and demand have to be forecasted from their current levels. The network coverage investment will not be affected by the forecast. The variable investment for customer connection will have to be determined on the basis of the relevant demand of the reference period.

49. The top-down model has to calculate investment for 100% network coverage plus the connection investment for the actual number of fibre connections and estimated new connections in the reference period. Then the operating costs for maintaining the assets and for fault repair that make up the network have to be identified. Finally, costs incurred have to be allocated between services.

50. Assets should be determined on actual asset counts which should be available from the asset register. The identified assets should be calculated to the predicted demand as described in para. 48.

51. If the assets in the asset register include service-specific assets of other than the L1 services, they have to be identified, separated and allocated to these other non L1 services.

52. The cost for trenching, ducting and the fibre cables have to be allocated between the feeder fibre and the distribution fibre components by using proper allocation keys, if they have not been registered separately from the start of network build. Typical allocation keys for trenching are the length of the trenches purely used for the feeder segment, the length of the trenches purely used for the distribution trenches and those trenches used for both network segments in parallel. For the latter the allocation may divide the cost by the number of fibres in use on average in these parallel segments. Such data may be derived out of the network documentation. The same holds for the costs of the FFP. Here the costs may be subdivided by the space used by the services in average.

53. The Central Office hosts various network elements. The OFDF and its space requirement has to be allocated to the L1 services. The CO is further used for co-location of L1 access seekers (including the LFC itself) plus eventually for co-locating L2 service equipment. A usually applied allocation key or cost driver is the

11 See MBIE, Broadband Deployment Update, December 2018.

space requirement of each usage, often described as footprints occupied. Costs for common traffic space, supporting facilities (i.e. fire alarm), restrooms etc. can be distributed to all footprints in use. Cost for power supply and air conditioning systems may be distributed by energy consumption, either by metering or by average values consumed by active racks.

54. Operating costs can conceptually be separated into several categories to better enable the allocation of shared OPEX to transaction and other services. The following categories are relevant:

    - Network operational labour cost (including network provisioning)
    - Network maintenance
    - Fault repair
    - Network accommodation
    - Network IT
    - Electricity
    - Marketing and sales OPEX
    - Business support OPEX

    Also these cost have to be allocated to the L1 services, transactional and other services using appropriate allocation keys.

55. The cost of capital are determined as the sum of the return of capital (depreciation) to earn back the invested capital and the return on capital to provide the yield for the equity and debt provided to finance the investment. Return on capital usually is calculated by reference to the capital asset pricing model based WACC.

56. Depreciation recognises the recovery of the initial fibre investment over the time period of the expected economic life of the fibre network. Ideally depreciation should reflect the decline in the value of an asset such that it is aligned with the consumption of the asset. In any case the depreciation method determines the allocation of the return of capital to customers over time and how customers contribute to that return as part of the (end-user) price.

57. As the Commission intends to apply straight-line depreciation in its building block regulatory model, it is highly recommendable to the LFCs also to use straight-line depreciation in their EOI pricing approach. Choosing a different approach, like for instance a tilted annuity approach for determining capital cost, would require a change in methodology after a few years. This would cause distortions in the market. Under a straight-line depreciation approach the initial investment is divided by the economic life of the respective asset to determine the annual return of capital. This method generates the constant depreciation charge in each year. In case of a

constant demand straight-line depreciation allocates the same amount of cost to each unit of the relevant wholesale product over time. In case of a growing demand a declining depreciation charge is allocated to each unit of product from one period to the next. In case of a declining demand the opposite effect occurs. A differentiation of the depreciation charge according to the level of demand or take-up in the fibre context, is – as the Commission rightly argues[12] – more relevant at a low level of penetration. It is, however, less relevant in NZ where a high level of take-up is already achieved.

58. Depreciation also is a factor to determine the return on capital. The net capital invested has to generate the return on capital to serve the financial requirements of equity and debt owners. The net capital is determined as the initial investment in the fibre network minus the accumulated depreciation up to the relevant period of calculation. The net capital is multiplied by the WACC to determine the return on capital charge for the cost calculation of that particular period. If there is no reinvestment or other changes in the asset base the net capital reduces steadily over the economic life of an asset. Under a constant WACC therefore the return on capital charge also reduces year by year.

59. The proper WACC has to be determined according to the company-specific risk profile in the fibre market and according to the company-specific return on equity requirements for such investment as well as company-specific debt rates.

60. The last cost category of common costs covers costs which occur at the company level and which have to be allocated to all services the company offers. This includes the following cost:

    - Top management
    - General administration
    - Legal and regulatory
    - Human Resources

    These costs do by definition not have service-specific cost drivers. Therefore, the usual way of allocation follows an equi-proportional mark-up approach on the attributable cost of each service. These attributable cost are usually, however, not available for all services. Therefore, a more simplified approach allocates these costs according to the revenue share of each service.

12 See Commerce Commission (2019), footnote 133.

3.4 Initial losses and Crown financing as part of EOI pricing

61. The legislative provisions which govern the new regulatory framework for fibre foresee that the LFCs can cover in their unbundled prices any "accumulated unrecovered returns" on investment made under the UFB initiative for the period from 1 December 2011 up until the implementation date.[13] If there are initial financial losses incurred they can be covered by the future pricing of the LFCs for the unbundled services. We doubt that it is efficient to start with a pricing approach which does not take care of incurred initial losses at the introduction of unbundling on 1 January 2020 and then switch to a pricing approach two or five years later which does take care of initial losses. The L1 unbundled price will be the universal input service for all LFC services. Therefore, it is essential to get this price right or efficient directly from its first introduction. Otherwise, RSPs would not get the proper incentives for making their buy or build decisions efficiently. Any change of the pricing principle is a change in this decision logic and not predictable to access seekers. Otherwise, their decision on which wholesale services to use may prove to be wrong at a later stage.

62. Initial losses basically occurred due to lower levels of take-up in the first years of operation. In the first twelve month of their operations there were actually no fibre customers connected. Uptake steadily increased over time passing the 20% mark just after four years and then accelerated to 30% after five years. Nevertheless, it took several years before the (annual) break even has been achieved. In some network areas that is not yet the case today.

63. The Act requires for the new regulatory regime to capitalise financial losses and treat them as an additional asset which is depreciated over time and has to bear interest. This approach may also be applied to complement the calculated costs of Layer 1 unbundled services for the 1 January 2020 price which meets the equivalence standard.

64. As part of the UFB initiative the Government provided capital to the LFCs which did not bear interest and thus did not cause capital costs to the LFCs. Some have already repaid the corresponding capital contributions. According to Section 176 (2AA) of the Act the actual costs (or better financial benefits) of the Crown financing should be taken into account in calculating the initial financial losses.[14] Effectively then financial losses are netted against Crown financing contributions. The Commission rightly mentions that all direct or indirect transaction cost have to be taken

13 See Section 176 of the Act and Commerce Commission (2018), p. 97.
14 See Commerce Commission (2018), p. 98.

into account to calculate the financial benefits of Crown financing. The Commission's assumption is that the actual cost of government financing is nil[15].

3.5 Non-price parameters of equivalence

65. Equivalence of access requires a level playing field for access seekers in price and non-price terms. EOI is designed and intends to avoid discrimination regarding[16]

    - quality of service,
    - access to information,
    - delaying tactics,
    - undue requirements and
    - strategic design of essential product characteristics.

    EOI is regarded as the surest way to achieve effective protection from discrimination as access seekers will be able to compete with the downstream business using exactly the same set of regulated wholesale products. EOI in non-price terms ensures technical replicability of the downstream (L2) service of the fibre company.

66. To support EOI a set of key performance indicators ("KPIs") should be represented in the service reference offers. KPIs are the most appropriate tools to detect potential discriminatory behaviour and enhance transparency. KPIs should be related to the key activities of the provisioning process covering all its stages like

    - the ordering process,
    - the delivery or provision of the service,
    - the quality of service including fault and fault repair times,
    - migration between different regulated wholesale inputs.

67. KPIs should be complemented by service level agreements ("SLAs") and service level guarantees ("SLGs").

15 See Commerce Commission (2019), p. 119, para. 538.
16 See European Commission (2013), rec. (12).

4 Inappropriate approaches

4.1 Pricing based on bottom-up costing

68. Regulatory authorities which intend to determine economic efficient access prices often make use of the instrument of bottom-up cost models. Bottom-up models are able to calculate total service long-run incremental cost ("TSLRIC") of regulated services in a greenfield environment. Reference and starting point of any bottom-up model is a hypothetical efficient operator which builds a cost-optimised hypothetical network. Network coverage is determined such that it meets actual demand for connections. Demand is usually assumed to reflect a steady state constant level. This means that in principle there are as many connections to the network which bear network cost as there are active customers on the network.

69. Network technology is determined at the edge of technology which is actually in use. Network architecture and structure is chosen such that it cost-efficiently meets actual demand. The path of the cabling in the access network is determined by optimisation algorithms. To determine costs for each network element assets are usually valued at their current (or replacement) cost which usually do not reflect the actual cost of an asset when originally installed. Real world information on asset prices, cost and other parameters inform the choice of the model parameters but do not fully determine them.

70. The TSLRIC generated by bottom-up cost models are assumed to provide the forward-looking costs reflecting current and ongoing future costs of providing the services and not todays actual costs. TSLRIC prices are assumed to generate the proper incentives regarding the "build or buy" decision of access seekers in terms of buying the wholesale service (at the TSLRIC price) or building a bypass network. TSLRIC should represent a hypothetical market price not generating monopoly profits. Only efficiently incurred but not inefficiently inflated costs are covered.

71. At a general level prices based on the actual cost of an operator may deviate strongly from prices derived from a bottom-up model. A priori there is no theoretical uniform relationship between the two cost calculation approaches: Actual cost can be lower or can be higher than costs calculated by using bottom-up models. Under the assumption that the costs are calculated for the same network the following factors may cause (major) differences:

    (1) Actual vs. hypothetical operator;

    (2) Actual network architecture vs. hypothetical optimized greenfield network structure;

    (3) Different modern equivalent assets assumed

(4) Historic cost vs. current cost valuation of assets;

(5) Dynamic demand pattern vs. steady state constant demand;

(6) Cost coverage based on actual and not hypothetical demand.

72. There are several reasons why the usual set-up and conceptual starting points of a bottom-up costing approach are not valid in the case of the LFCs. This follows mainly from the conditions which the LFCs had to meet to apply for a fibre partnership with the CIP/the Government. Furthermore, it followed from the architectural and roll-out requirements set by CIP and fixed in undertakings with the LFCs. In addition CIP even fixed the commercial conditions under which the LFCs could offer their wholesale services. This set-up has mostly determined costs and revenues of the LFCs and not their own business decisions.

73. A hypothetical efficient operator (HEO) may not have taken the following business decisions:

(1) The HEO might have chosen a P2P instead of a predominant P2MP network topology.

(2) A HEO might not have chosen the same network coverage as the LFCs. In particular a HEO would not cover 100% of all buildings in a given coverage area.

(3) The HEO might have managed a closer fit of network roll-out and revenue generation.

(4) A HEO would have chosen a different L2 price than the price determined by CIP. This price would be different between LFCs because their costs of network service provision differ.

74. These major examples show that LFCs have not been able to take major network related business decisions on their own efficiency and profitability considerations. It does not make any sense to relate pricing decision on a greenfield (potentially) more efficient network structure when LFCs were obliged to build their networks in exactly the form as they did it. When the Government via CIP basically determined the structure of the fibre networks as build by the LFCs, then the Government also is under the obligation to provide a regulatory framework which allows fibre investors to achieve a fair market return on the capital they invested.

75. For all reasons mentioned so far a HEO reference point and the calculation of service costs with a bottom-up model tool is not suited to fit with the environment under which the LFCs had to build their fibre networks.

76. One feature of bottom-up calculated prices is that they represent the efficient costs of network operation. Why do LFCs also operate efficiently in their market environment? Although there is only one and not several fibre networks in a region, fibre services are not provided in a monopolistic market structure. LFCs first of all face competition from mobile operators which have been rather successful over the last few years to penetrate fixed wireless access solutions in the market. In the region of Christchurch Vodafone has upgraded the cable network to provide ultrafast broadband access. Furthermore, Chorus has upgraded its copper network with vectoring technology in the other LFC coverage areas making it capable to speeds which also the fibre networks offer. Given this competitive environment LFCs have to be efficient to be competitive. Furthermore, it has to be mentioned that LFCs became partner of CIP to build the fibre networks on the basis of a competitive bidding process. Major bidding parameter was the degree of network coverage offered at a given financial contribution of the Crown. Because there was intense competition for the fibre network market, LFCs were forced to efficiently build their networks under the architectural and topology constraints prescribed by CIP.

4.2 Pricing derived from margin squeeze considerations

77. In its submission to the Commission's consultation paper on a new fibre regulation regime Vodafone (2018) proposed (among other options) an economic replicability test ("ERT") to meet the EOI standard for fibre unbundling pricing. An economic replicability test in this context would require the proof that there is sufficient economic space between the Layer 2 bitstream price and the unbundled Layer 1 price. According to this concept an equally efficient access seeker purchasing the Layer 1 service from the LFC will be able to compete against the LFC in respect of the Layer 2 service or against other RSPs at retail which rely on the Layer 2 wholesale service.

78. Technically, the ERT follows the value chain relationship of the L1 service as the upstream and the L2 as the downstream service. Starting from the L2 price the ERT would deduct the cost of the bitstream-specific network elements to come up with the Layer 1 price. In the network concept of the LFCs these deductable network elements would be the OLT (including the co-location space and cabling) and the ONT including their operational expenditures and the cost for the feeder, if applicable.

79. The ERT or margin squeeze concept is usually applied in a situation where a vertically integrated operator with market power in a key upstream market supplies competitors in downstream markets prices for wholesale inputs in a way that makes it unprofitable for competitors to provide products in the retail market. Therefore the key focus of a margin squeeze test is the difference between the upstream and the

downstream price. This difference should be high enough to cover own network costs of the competitor plus its reasonable retail costs.

80. A margin squeeze may also arise between different wholesale products. Margins between various wholesale products (or business models) along the vertical value chain are squeezed if there is not sufficient economic space (or margin) between various wholesale products such that various business models along the value chain of the ladder of investment are viable. Margin squeeze tests in this context shall ensure consistency of wholesale prices along the value chain based on the principle of competitive neutrality between different business models. Vertical consistency of pricing should enable efficient competition at different levels of the value chain.

81. Application of the economic replicability concept to determine a wholesale price in a vertical relationship leads to efficient pricing under certain circumstances. If the downstream service price (the L2 price in our context), however, is not efficient then the resulting upstream price (the L1 price in our context) resulting from applying the ERT methodology would not be efficient either. Or to put it in other terms: if the L2 price is not cost-based then the L1 price resulting from the ERT methodology would neither be cost-based. If the L2 price is causing a loss then also the resulting L1 price would generate a loss. Thus, the ERT pricing loses its nice properties totally if the reference price is distorted.

82. We have demonstrated in para. 21 that the L2 price is not the result of economic efficiency considerations. Instead, it is the result of political decision making. Furthermore, it is significantly distorted because it does not represent the cost of a particular LFC and does not take care of major cost differences between LFCs.[17] In particular if one takes into account initial losses than the level of the L2 price is not cost covering.

83. All reasons summarized in para. 82 lead to the conclusion that the current Layer 2 price is in various respects distorted if compared to an efficient price (level). Therefore it cannot be the reference point for determining the L1 price following an economic replicability consideration. If that would nevertheless be the case, then not only the L2 price but also the L1 price and therefore the whole pricing system would be distorted.

84. The unbundled L1 product and its price will become the universal input service for all LFC services. Therefore it is essential that this price is properly and efficiently determined. The benefits for RSPs of getting access to unbundled L1 services goes far beyond the point of being able to replicate the L2 price of the LFCs.[18] The main

17 For details we refer to para. 44.
18 See Vodafone (2018) and Spark (2018).

benefits follow from their ability to use their own active equipment and to get the ability of flexibly defining their own service features and capabilities. As Vodafone argues: "*Rival companies can then invest in their own equipment creating a competitive market over features such as access speeds, latency and resilience.*"[19]. To make such decisions and investments it is also in the best interest of RSPs to start with the appropriate and stable price level for the unbundled Layer 1 services. Distorted wholesale prices also distort investment decisions of RSPs and are not stable over the longer term.

19 Vodafone (2018) para. 16.

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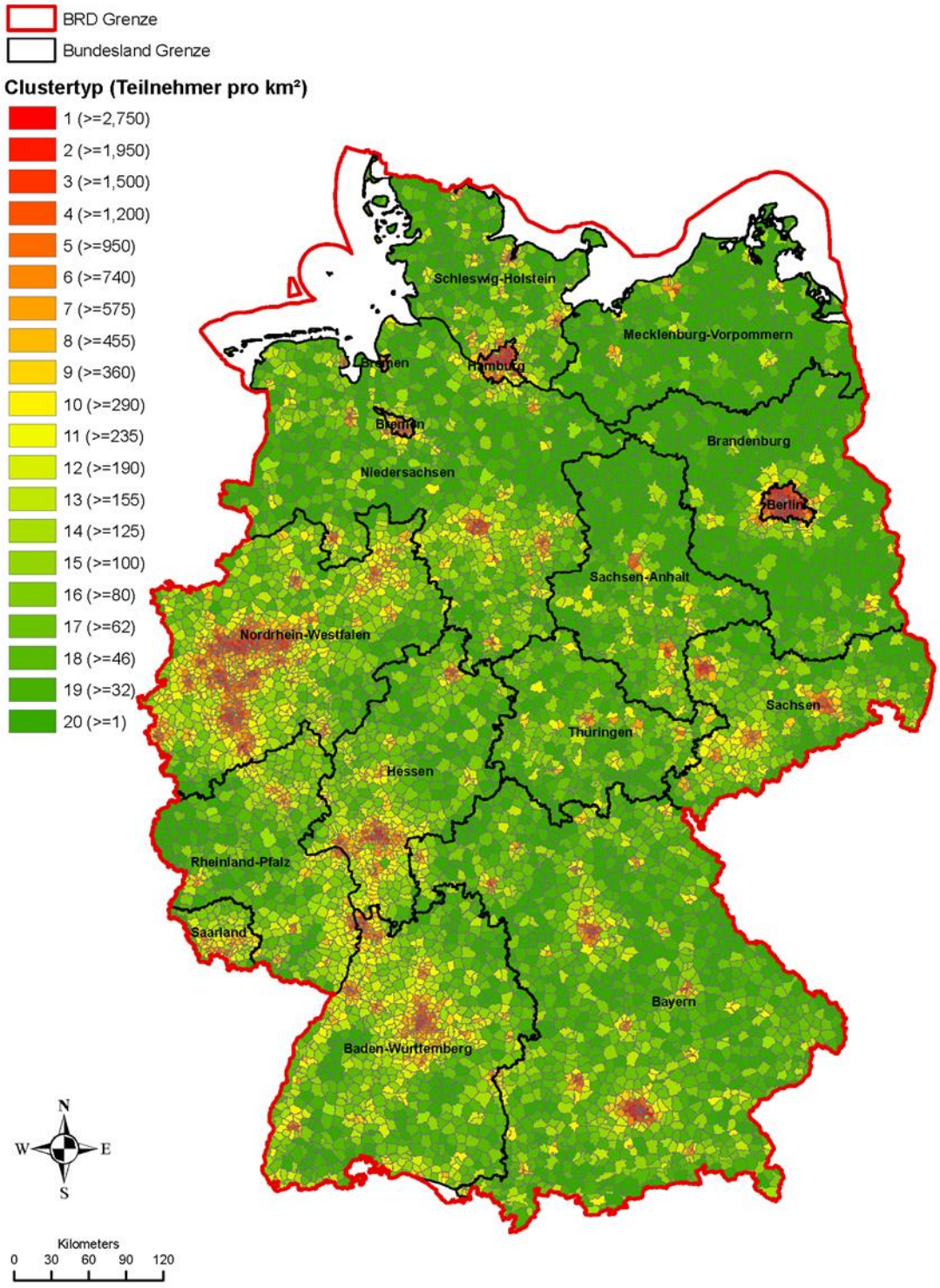
Annex A Customer density and fibre cost

Figure A - 1: MDF Clustering for Germany



Source: Jay, Neumann, Plückebaum (2011)

Table A - 1: Investment per home connected at 70% penetration

Cluster	FTTH/P2P	FTTC Vectoring	Delta in %
1	1,440 €	320 €	78%
2	1,650 €	350 €	79%
3	1,740 €	370 €	79%
4	1,780 €	370 €	79%
5	1,840 €	370 €	80%
6	1,940€	380 €	80%
7	2,010 €	410 €	80%
8	2,180 €	420 €	81%
9	2,230 €	440 €	80 %
10	2,410 €	480 €	80 %
11	2,440 €	500 €	80 %
12	2,480 €	520 €	79%
13	2,560 €	560 €	78%
14	2,640 €	600 €	77%
15	2,650 €	590 €	78%
16	2,710 €	640 €	76%
17	2,670 €	680 €	75%
18	3,030 €	830 €	73%
19	3,410 €	1,020 €	70%
20	4,310 €	1,390 €	68%
Average	**2,410 €**	**560 €**	**77%**

Source: Jay, Neumann, Plückebaum (2014)

Important to understand the investment differences of FTTC Vectoring and FTTH/P2P is that the investment in FTTH is covering the access network from the Central Exchange to any home passed, distributed to every home connected, while the investment for FTTC Vectoring only includes the cost form Central Exchange to the cabinets and the DSLAMs inside, but no invest for the distribution subloop, because they are already existing. For business calculations they are rented as subloops, thus are OPEX.