WIK-Consult • Report

Report for Telecom New Zealand and Vodafone New Zealand

Submission

In response to the Commerce Commission's "Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services (9 July 2014)"

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Executive Summary

1. WIK-Consult (WIK) has been requested by Telecom New Zealand and Vodafone New Zealand to support them in the course of the Final Pricing Principle price review and the attendant further cost modelling for UBA und UCLL services, undertaken by the Commerce Commission. Below we summarise the major points of our independent expert report on the Commission's "Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services".

2. The Commission's consultation paper is a major step forward in identifying the key modelling principles and methodologies that the Commission and its consultants are going to apply in developing the TSLRIC model. WIK agrees with a substantial number of the positions taken by the Commission for implementing the TSLRIC approach and making it more precisely applicable to the modelling requirements. We fully support the general principle and approach of the Commission to base its cost model on a Modern Equivalent Asset (MEA) network which represents the efficient (least-cost) provision of the relevant services. **We also share the Commission's view on MEA, that a hypothetical efficient operator would choose a combination of FTTH and FWA to efficiently provide access services over the fixed network today. Here we support the proposal of the Commission, following TERA's recommendation, to build a second FTTN model beside a FTTH model in order to implement a least-cost approach for UCLL.**

3. However, WIK identified aspects of the Commission's approach that would benefit from further clarifications. The re-use of civil engineering assets is entirely consistent with the concept of calculating the costs on the basis of a TSLRIC model. An increasing number of regulators have come to the conclusion that non-replicable assets of the legacy infrastructure, which are re-useable for building MEA networks, can be and should be valued in a different way than not according to their current replacement cost. Consistent with this, the European Commission regards its dual asset valuation approach not as a new cost standard but as the proper and appropriate implementation of TSLRIC in the specific circumstances of the migration to NGA. Additionally, investors are expecting that operators make best use of their existing network assets which are re-usable when deploying a new network in order to be efficient. **Thus, also WIK recommends a Brownfield approach of deriving the costs of a MEA network, since otherwise, besides the risk of double cost recovery of fully depreciated civil engineering assets, inefficient network investment decisions may be the consequence.**

4. We are sure that the Commission is aware that the sharing of network elements with other (types of) networks is a key element in structuring and building a network that efficiently provides services at least cost. Sharing has a major impact, in particular on the cost of civil engineering infrastructure, but is not limited to it. **WIK recommends, that the Commission address sharing and its various levels and forms in the appropriate detail, which is necessary to identify cost savings and to implement it in the cost model.** Therefore we present our view of sharing classifications and of examples for international best practice. These include internal sharing within the same Telco business (within the same and between different network levels and between different services) and external sharing between separate operators of the same sector or of different sectors.

5. The Commission appears to favour a scorched node approach for determining network costs. **WIK proposes a modified scorched node approach that is capable of identifying efficient costs in that it should avoid accepting too closely the existing scorched node structure, that due to** historic growth has resulted, from today's point of view in inefficiencies. Within the MEA bottom-up cost model, such an approach considers further possible cost reductions of a hypothetical efficient operator by allowing, for example, to

- change the number of ODFs incrementally,
- place the cabinets efficiently in the case of the reference copper network architecture,
- shape efficient local access areas at a given number of ODF nodes,
- include new home or business area locations or delete old ones,
- include new roads that allow for different access to areas etc.,
- optimize the routing of the access lines along the streets,
- substitute technical equipment and follow new developments.

A modified scorched node approach is best international regulatory practice.

6. **While WIK supports the Commission's approach to allocate those not directly attributable network costs by an output- or capacity-based method, WIK follows the common regulatory practice of rejecting the Shapley/Shubik method.** By creating the potential for cross subsidization, the Shapley/Shubik method contradicts the fundamental idea of the efficient service provision. The proper method for allocating the cost of the shared infrastructure is according to its relative utilization by the various services, most appropriately on the basis of relative output shares.

7. Although the Commission's consultation paper is a major step forward, it leaves important modelling aspects open. **This leads us to the clear recommendation**

that the Commission and its modelling consultants should prepare and publish a model reference document which enables market players to get a detailed overview how the model elements are actually structured, how the network elements are precisely defined, how the data generation and processing process actually feeds the model with the relevant parameters, which algorithms are used in the model, how they are defined and applied for service and cost efficiency. Such a model reference document should have the character of a high level specification of the model. Only on the basis of such a document it becomes possible that all the knowledge and expertise of network operators and RSPs can be made fruitful to the Commission's modelling exercise

1 Introduction

8. WIK-Consult has been appointed by Telecom New Zealand ("Telecom") and Vodafone New Zealand ("Vodafone") to support both companies in the course of the further cost modelling and FPP process of the Commission. Nevertheless, this submission is brought to the attention of the Commission as an independent expert report.

9. For better reading and comparison this submission follows in its structure the structure of the Commission's consultation paper of 9 July 2014. If not otherwise stated all references in this text ("***para.***") relate to the respective paragraphs of the Commission's text.

10. In Chapter 7 we will deal with some key modelling aspects which we did not see covered neither in the Commission's consultation document nor in TERA's[1] document. We will also mention some aspects which we would not see as being covered in sufficient detail. Not addressing these aspects in the current document and some other important aspects in this context leads us to the clear recommendation that the Commission and its modelling consultants should prepare and publish a model reference document which enables market players to get a detailed overview how the model elements are actually structured, how the network elements are precisely defined, how the data generation and processing process actually feeds the model with the relevant parameters, which algorithms are used in the model, how they are defined and applied for service and cost efficiency. Such a model reference document should have the character of a high level specification of the model. Only on the basis of such a document it becomes possible that all the knowledge and expertise of network operators and RSPs can be made fruitful to the Commission's modelling exercise.

11. We do not submit on the papers prepared by TERA and Vogelsang[2] separately. We will refer to specific aspects of these papers in the context of the relevant paragraphs of the Commission's consultation document.

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1 TSLRIC price review determination for the Unbundled Copper Local Loop and Unbundled Bitstream Access services: Modern Equivalent Assets and relevant scenarios; TERA for Commerce Commission, Ref: 2014-20-DB-The Commission-MEA; July 2014

2 The effects of the UCLL contribution to the UBA aggregate on competition for the long-term benefit of end-users in New Zealand telecommunications markets; Ingo Vogelsang; version July 2, 2014

2 Regulatory framework

2.1 TSLRIC and forward-looking costs

12. The Commission follows the general notion that TSLRIC prices should incentivise efficient build or buy signals and choices (***para. 30***). Although this notion holds in principle, regulators around the world recognize that in the real world certain elements of the network are not replicable and therefore the build or buy notion has no meaning for such assets any more. This starting point brings more and more regulators to the conclusion that non-replicable assets of the legacy infrastructure which can be re-used to build new NGA networks can be and should be valued in a different way and not according to their current replacement cost.

13. The Commission seems to assume (in ***para. 145***) that the asset valuation approach for re-usable civil engineering assets which the European Commission is proposing in its costing methodologies recommendation is not in line and is not consistent with a TSLRIC approach. This is actually not the case. The European Commission is regarding its dual asset valuation approach not as a new cost standard but as the proper and appropriate implementation of TSLRIC in the specific circumstances of the migration to NGA. This is the logic the Commission should also follow in New Zealand and should regard a different valuation approach for non-replicable re-usable civil engineering asset not as a change in its TSLRIC methodology but as an appropriate implementation of it.

14. For the same reason we do not follow TERA's argument (pp. 51, 65) that a bottom-up modelling approach necessarily requires to value all assets according to their current replacement costs. It is neither needed nor appropriate to switch to a top-down modelling approach to integrate a different valuation approach for re-usable civil engineering infrastructure. This can be handled within the framework of a bottom-up cost model.

15. The Commission also seems to assume that the valuation of certain assets at less than their current replacement costs is not coherent with the expectation of investors and therefore not coherent with Section 18 (see ***para. 59, 80, 86***). We believe that the opposite holds: Investors are expecting that operators make best use of their existing network assets which are re-usable when deploying a new network. Otherwise, operators would not minimize deployment cost and would not manage their investment to the long-term benefits of investors <u>and</u> of end-users which should be the reference point of the Commission.

16. For this reason the European Commission clearly recommends a so-called Brownfield approach of deriving the costs of an NGA-MEA network. Building an NGA network on a Greenfield basis requires to newly invest in all relevant network elements. In contrast a Brownfield approach makes use of existing assets as far as possible to save resources and cost. According to the European Commission's costing methodologies recommendation NRAs "should include any existing civil engineering assets that are capable of hosting an NGA network. Therefore, when building the BU LRIC+ model, NRAs should not assume the construction of an entirely new civil infrastructure network for deploying an NGA network".[3] In order to avoid over-recovery of costs, the methodology outlined in the recommendation foresees the determination of a Regulatory Asset Base (RAB) for reusable legacy civil engineering assets (ducts, poles, etc.) through the indexation method:

- this method relies on historic data on expenditure for the reusable assets, accumulated depreciation and asset disposal as well as the indexation through an appropriate price index;
- reusable legacy civil engineering assets still in use but fully depreciated are not to be included in the RAB.

Thus, the Regulatory Asset Base (RAB) consists of the historic costs of the reusable civil engineering assets not completely depreciated, net of the accumulated depreciation at the time of calculation and indexed by an appropriate price index. The indexation ensures that historic costs are "updated" to reflect today's value of the investment, i.e. prices that would have to be paid today for these assets.

17. Although the European Commission regards cost recovery (of "efficiently incurred costs") as a key principle in a costing methodology, it also has concerns on an unjustified over-recovery of costs. In particular for this reason the European Commission has proposed that NRAs should value all assets constituting the Regulatory Asset Base (RAB) of the modelled network on the basis of replacement costs, except for re-usable legacy civil engineering assets. Those assets are unlikely to be replicated. Although being part of the copper access network they can be re-used to build the NGA network. The assets mainly under consideration here are ducts, trenches and poles. This approach avoids the risk of a cost over-recovery because major parts of the legacy civil infrastructure are often fully depreciated. An over-recovery of costs would not be justified to ensure efficient entry and preserve the incentives to invest because the build option is not feasible for these assets. The locking-in of the RAB ensures that once an asset is fully depreciated, this asset is no longer part of the RAB. In that case it no longer represents a cost for the access provider and it is not justifiable that it would represent a cost for the access seeker. The issue of reusability of civil engineering assets is of similar importance

3 EU Commission Costing Recommendation, rec. 32.

in NZ as it is in Europe. Chorus (and other operators) will make their best use of such assets in building the fibre network and this should be reflected in the Commission's FTTH/FWA MEA.

18. Prior to the European Commission recommendation, Ofcom had already introduced a dual asset valuation approach in its LRIC determination of ULL charges. In 2006 Ofcom changed its general approach of asset valuation according to current costs to a historic cost based valuation of certain assets. Assets deployed in BT's access network before 31 December 1997 are valued on the basis of an RAB approach as the European Commission just recently also has recommended.[4] Assets deployed after that date are valued at their current replacement costs.

19. In ***para. 146*** the Commission seems to focus attention on a relationship between the valuation of re-usable assets and the question of whether or not there is a regime for mandating access of ducts. We clearly want to emphasize that both concepts are conceptually unrelated and distinct. The concept of re-usability addresses the situation of whether or not and to what extent assets of the legacy network infrastructure can be re-used to build the MEA network infrastructure. The issue of mandating access to ducts addresses whether third party operators have access to the legacy infrastructure or not. Both concepts are only related through the impact which mandated access might have on the amount of re-usable assets which can be used in deploying the new MEA network. Not mandating access to ducts does by no means conceptually exclude the re-valuation of re-usable assets. In any case the hypothetically efficient operator has access to re-usable assets of a variety of operators and utilities on a make-or-buy perspective. It is also important in this context to remember the notion of the hypothetical efficient operator. This operator is not assumed to be a new entrant competing against Chorus e.g. on the basis of getting access to Chorus' ducts. The hypothetical operator is to be regarded as the operator providing UCLL and UBA (and other) services efficiently.

2.2 Modern equivalent asset

20. We fully support the general principle and approach of the Commission to base its cost model on a Modern Equivalent Asset (MEA) network (***para. 150***) which represents the least-cost replacement of the relevant services (***para. 6.1***). This represents the decision of a hypothetical efficient operator which would make the investment decision for an access network today. This decision should also be represented in the TSLRIC model and should inform the regulator on relevant costs.

4 https://circabc.europa.eu/sd/a/c30f82fd-c2ad-462a-a9de-01117a285dd6/UK-2011-1201%20Acte_3__EN+date+nr.pdf,

21. We also share the Commission's view that an efficient operator would choose a combination of FTTH and FWA to efficiently provide access services over the fixed network today. The Commission proposes, that a mixture of FTTH and FWA should be the basis for the UCLL MEA and that the FWA area will be represented by the current and projected RBI fixed wireless footprint (***para. 163, 164***).

22. We do not understand why the Commission proposes to limit the efficiency contribution of FWA to the edges of the network determined by the currently projected RBI fixed wireless footprint (***para. 164***). Parts of the Chorus legacy network are already based on a wireless access solution. Due to the poor broadband performance of long copper loops Vodafone is providing broadband connections as wireless access in the state-funded Rural Broadband Initiative (RBI). Therefore, there have already been political decisions, taking cost-value ratios into account, not to invest into high-speed fixed access network in areas where this would be prohibitively expensive. Such decisions related to the RBI are to our knowledge not derived from and driven by considerations to replace the fixed network at lowest replacement cost in a TSLRIC sense. The Commission should clearly follow its general principle as expressed in ***para. 6.2*** to look for the least-cost replacement of the whole network. The cost model of the Commission should be the tool to identify the least cost provision area of access under the structural cost and terrain conditions in New Zealand. Thus, the area where FWA will be providing the access services at lowest cost compared to the FTTH network MEA should be an output of the Commission's model and not an a priori assumption which does not allow for optimization and for identifying the least cost network configuration.

23. A reasonable forward looking approach also takes the current and upcoming technological evolution into account. In particular the further development of LTE has to be regarded (see also TERA report, p. 25, Table 3) and consequently LTE projects, which are likely to be projected in the upcoming regulatory period and which might provide higher bandwidth per customer compared to today's FWA.

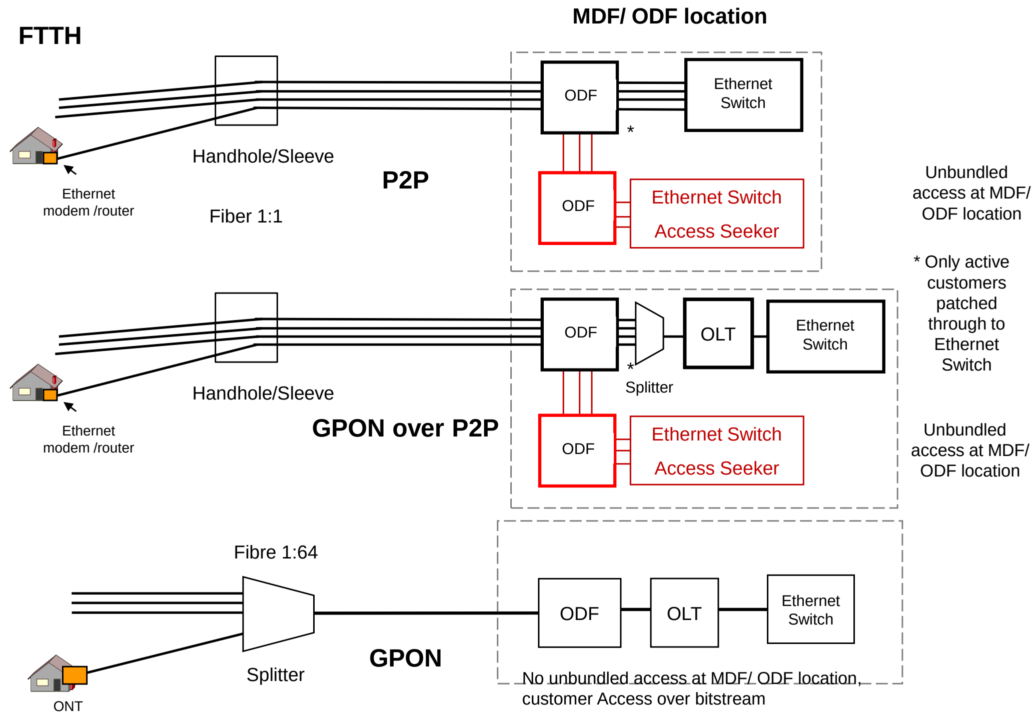
24. The Commission does not explicitly address which architecture of the FTTH network will be the basis for its model. TERA (p. 37 ff.) discuss the differences between a P2P and a GPON approach towards fibre technology and clearly recommends to the Commission to use a P2P approach. We support the use of a P2P topology for the fibre network as the basis for the FTTH model because this is the most flexible and future-proof architecture which also meets the fibre unbundling requirements in New Zealand at a later stage.

25. There is a discussion about FTTH access networks debating FTTH P2P (with Ethernet switches concentrating the traffic) vs. FTTH GPON. This discussion is often misleading. GPON is most commonly understood as a fibre Point-to-Multipoint (PMP) topology deploying splitters in the field, but there also exists the

option to instead deploy the splitters at the ODF locations, thus using FTTH P2P fibre topology up to the ODF. We want to bring to the attention of the Commission that a P2P and a GPON approach therefore are less mutually exclusive than often assumed. Taking a long term forward looking approach into account, a P2P fibre topology offers the best opportunities concerning the criteria unbundling and covering increasing bandwidths according to the individual end-customer demand. Alternatively to P2P a 'GPON over P2P' architecture is more suitable as a UCLL MEA. This architecture also guarantees unbundling at the ODF using a P2P fibre topology whilst it reduces the UBA costs through using a splitter behind the ODF with the effect of saving interfaces of the Ethernet switch. Figure 2-1 illustrates the differences between these architectures: Moreover, the upcoming regulatory period has to be regarded. GPON is due to its smaller costs used for connecting residential customers and small businesses (TERA, p. 16). It has to be checked how far GPON will be substituted by P2P architecture in the upcoming regulatory period in the corresponding areas.

26. GPON over P2P combines the advantages of both the architectures GPON (over Point-to-Multipoint, PMP) and P2P. It first of all allows to physically unbundle each end-customer access line due to its P2P fibre topology. There is a trade-off between the higher amount of feeder fibre compared to a PMP solution. These are, however, additional fibres in an anyhow deployed trench, requiring a smaller amount of additional investment. The advantages are, that the splitters are located in the ODF locations and can be used according to changing demand, while decentralized splitters in the field typically cannot be fully loaded with access lines. Thus, a lower number of splitters is required and as a consequence smaller OLTs. As a second advantage the passive splitters concentrate the end-customer traffic onto a reduced number of electronic interfaces and thus save investment compared to an Ethernet P2P solution. This can be achieved more efficiently at central locations compared to the PMP decentralised approach. This also has an efficiency increasing effect on the production of UBA. In addition, customers with an extraordinary demand for access (symmetric traffic, dedicated bandwidth, high transmission rates (1 Gbit/s or higher), business customers) can be served individually via P2P fibre access lines. According to our studies the cost difference between GPON (PMP) and GPON over P2P is minor at around 1% (see sources below Figure 2-1).

Figure 2-1: Overview of FTTH P2P, GPON over P2P and GPON topologies



Source: Plückebaum, T.; Jay, S.; Neumann, K.-H.: Comparing FTTH access networks based on P2P and PMP fibre topologies, Conference on Telecommunications, Media and Internet Tecno-Economics (CTTE) 2011, Berlin, 16. - 18. May 2011, http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5897963&url=http%3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Ftp%3D%26arnumber%3D5897963

Jay, S.; Neumann, K-H.; Plückebaum, T.: Comparing FTTH access networks based on P2P and PMP fibre topologies, Journal on Telecommunications Policy (JTPO), 8. Juli 2013, http://authors.elsevier.com/sd/article/S0308596113000694

27. The Commission does not reveal whether it intends to follow a scorched node or a modified scorched node approach in modelling its FTTH network. This is a major starting point for the whole modelling process. TERA (p. 48) is proposing to use a scorched node approach which uses the MDF nodes of the current copper network in New Zealand and the boundaries of each MDF area also as the boundary of the ODF areas of the fibre network. We understand that this is a pragmatic approach but it misses its justification with regard to efficiency of the network. Although we understand that it might not be appropriate to consider a more efficient totally new node structure, we would not understand why it should not be possible at this stage of model development to make use of the efficiency gains of a modified scorched node approach. Although it is more common to use a scorched node approach than a scorched earth approach, it is not commonly adopted as part of a forward looking TSLRIC modelling exercise (***para. 153***) to keep the scorched node approach without changes. Many regulators modify the scorched node assumptions for

certain network elements improving the efficiency of the network and service provision. We propose that the model to be developed provides the flexibility to allow for efficiency improvements due to incrementally changing the number of ODFs, the efficient placement of cabinets in the case of the reference copper network architecture and for efficient local access areas at a given number of ODF nodes.

28. This will be illustrated by the following examples: Typically, an access network changes over time and will be expanded or dismantled due to new build homes and moving of people. Thus, new home or business area locations might be added or others might have to be removed, new roads allow for different access to areas etc. In order not to depend on a path dependent network topology and resulting inefficiencies from today's point of view one may deviate from a strict scorched node approach to the benefit of efficiency. Thus the local access areas may be delineated newly. Also the routing of the access lines along the streets may be optimized, and cabinet locations may be optimized according to new and efficient size and sub-loop length restrictions. These improvements do not change the basic topological characteristics of the UCLL service. Besides these infrastructural changes the kind, function and capacity of the network systems located in the network nodes may change over time (e.g. PSTN upgrades to VoIP or DSLAMs in cabinets In addition there might also be the dismantling of small MDF's included into the scorched node approach, where the small MDF functions are transferred to an existing neighbouring MDF without changing the general node structure, but improving network efficiency.

29. The Commission briefly comments in ***para. 164*** (footnote 110) that it will not include any subsidy received by Chorus for its RBI contract in the model but it will consider it in the subsequent cost to price analysis. This issue needs more attention by the Commission. The hypothetical efficient operator will work and invest under the actual conditions in New Zealand. The Government is providing significant funds to build the new access network in New Zealand. Funds are provided under the UFB and the RBI initiatives. The Commission should as a reference point assume that its hypothetical efficient operator will have access to such funds in the same way as operators active in the New Zealand market today reducing the investment requirements to build the new network. The Commission should develop a systematic approach to take these financial contributions of the Government into account to determine TSLRIC prices.

30. The Commission intends to use a different MEA for UBA costs as for calculating the cost of UCLL. This starting point by itself is not compatible with the rational business decision of a hypothetical efficient operator. The hypothetical efficient operator serving both, UCLL and UBA, will not construct two network infrastructures in parallel, one for each kind of service, but only one, because the MEA can support both services. The Commission does not properly reflect how to deal with potential

inconsistencies following from this dual MEA approach. This results primarily from the unclear and unspecified notion of “the use of copper based inputs” (***para. 173***) of the actual Chorus copper network. Would this mean that the Commission intends to model the distance between the active cabinets to the MDFs on the basis of Chorus’ actual network or would it mean something different? In any case the existing cabinets do not necessarily reflect the structure of an efficient copper network. Why does the Commission not consider further optimization and cost efficiency opportunities at this stage? It is possible on the basis of appropriate algorithms to derive the structure and number of cabinets such that they meet efficiency requirements. We would clearly recommend such an approach instead of using Chorus’ existing cabinet structure.

31. There is another aspect of consistency following the dual MEA approach of the Commission. For UCLL the Commission chooses a FTTH/FWA MEA approach whereas relating to UBA the Commission prefers a pure copper approach without regarding FWA areas (***para. 168***). For consistency considerations of the network and service scope of the hypothetical efficient operator the Commission should include also the FWA areas of the fixed network into the calculation of the UBA cost. Bitstream can be and will be produced in New Zealand over fixed wireless access.

32. TERA stated, that a single MEA for UCLL and UBA would be inconsistent with the actual level of economies of scale for UBA because FTTH would support traffic of ultra-fast broadband only customers (pp. 67/68). Today and also in the future, however, ultra-fast broadband only customers will use the common Ethernet core network. So there is cost sharing concerning the use of the Ethernet core network by all broadband users: ultra-fast broadband users and “average” broadband users. So in the case, that a copper access network would be selected as a basis for calculating UBA MEA costs the traffic of all broadband customers has to be taken into consideration. Otherwise, the efficient UBA costs per customer would be overestimated due to reduced economies of scale in the Ethernet core network. In the case that FTTH is the MEA and replaces the copper network for all access lines it will also transport low bandwidth user traffic and thus will reflect the total bitstream traffic.

33. TERA (p. 73 f) has clearly identified the implication of double recovery of costs if a different MEA will be used for calculating the cost of UCLL and UBA. We fully share the analysis of TERA that double-recovery (if not avoided at all) should be identified and removed. The Commission has not revealed whether it would share TERA’s analysis and how it intends to manage over-recovery of costs. TERA’s proposal is a consistent approach of dealing with the double-recovery issue depending on how it is modelled in detail. The Commission should follow TERA’s recommendation if it will not change its MEA view.

2.3 Adjustments

34. The Commission intends to follow TERA's recommendation to build two network models, for a copper network and a FTTH/FWA network, and deciding whether or not to make a cost adjustment to the FTTH MEA depending on the results in order to identify the least cost. Here the Commission does not (totally) clarify, whether it will adjust its cost estimates, if the copper network costs are lower than the FTTH network costs. WIK recommends that the Commission clarifies, that it will follow TERA's recommendation how to adjust its TSLRIC model. Also, it would be necessary in the case that copper network costs are lower than the FTTH network costs, that TERA clearly advises that an adjustment is necessary.

35. The Commission as well as TERA do not report how they intend to model the reference copper network. To make the cost adjustment properly, the copper network has to be modelled using the same optimization and efficiency considerations. This means in particular that not only the FTTH network should be complemented by fixed wireless access in low density areas. The same should hold for modelling the copper network. Also in this case the least cost solution technology should inform the relevant access cost.

36. Furthermore, the Commission should build the model such that it enables flexibility to test the efficiency improvement of a modified scorched node approach with regard to the number and location of cabinets, the MDF areas and the number of MDFs.

2.4 Promoting competition and economic efficiency

37. The following comments are exclusively dealing with economic efficiency aspects of pricing. They are not related to any legal interpretation or positioning with respect to section 18 considerations.

38. We strongly support the principle of competitive neutrality in respect of business models which the Commission has committed to in ***para. 88***. Efficient outcomes in a competitive market require that the relevant business models will be the result of strategic business decisions in a competitive market environment based on efficient wholesale prices determined by the regulator. If the regulator would artificially incentivize certain business models e.g. unbundling or the use of UBA services, he would distort such business decisions and would not support or even hinder efficient market outcomes which are in the long-term interests of end-users.

39. Competitive neutrality at this level is best served by wholesale access prices which reflect the TSLRIC of the respective services. If the TSLRIC prices are derived from a uniform modelling structure which is applied in a coherent and consistent way,

then the resulting pricing structure of the UCLL and the UBA services are in an efficient balance to each other. The price difference generates the sufficient economic space which allows efficient operators to use the unbundling model where that is more appropriate not only from a firm's strategic perspective but also from the perspective of the economy at large and the long-term interests of end-users. There is no need and no room for artificially incentivising any business model.

40. The same considerations are relevant with regard to relativity between the UCLL and UBA prices, the Commission is referring to in ***para. 66 ff***. As long as TSLRIC prices are developed under the same model structure, cost model-based TSLRIC prices generate the sufficient economic space to make the efficient business decisions such that those business models can be chosen which best fit with efficiency and the long-term interest of end-users. Properly developed cost models calculate the cost of those network elements which are needed for efficient operator to produce the next rung of the value chain from one wholesale service to the next. Those cost differentials generate the relevant economic space for an efficient operator to produce one wholesale service (e.g. UBA) by using another wholesale service (e.g. UCLL) as an input.

41. The efficient pricing of UCLL and UBA raises further issues of competitive neutrality which are relevant in the New Zealand context and which the Commission did not (yet) address. Level and structure of the UBA and UCLL prices are also an important baseline for the platform competition of the fixed network platform against cable and mobile. If the Commission artificially increases UCLL and UBA prices, it will distort the platform competition in favour of cable and mobile at the expense of the fixed network platform. This will hurt Chorus in particular as the dominant provider of the fixed network infrastructure in New Zealand but also the RSPs. One may argue that the effects towards cable are small because of the limited footprint of cable networks in New Zealand. Nevertheless, where cable is present in New Zealand, it is highly competitive and successful. Even small price increases above the level of relevant TSLRIC will then have competitive effects. Given the universal availability of mobile broadband in New Zealand these effects will be stronger here and will strengthen the path of fixed-mobile migration.

42. There is another aspect of competitive neutrality which is rather New Zealand-specific in its degree. This issue has got and will get high attention in New Zealand and the Commission has touched upon it briefly: The competition of the copper network platform against the UFB platform. Regulatory measures also face concerns of competitive neutrality if the migration towards the future-oriented fibre platform is to occur in an efficient manner. The Commission should also take care in regard to the opportunity for efficient competition between services provided over the current network platform and those provided over the UFB fibre platform. Access seekers purchasing UCLL and UBA services should be able to compete

against fibre-based services. The Commission should maintain the role of services provided over the copper network platform as a competitive constraint on services provided over the fibre network platform. Customers using services based on those wholesale products should not be burdened with artificially increased prices incentivizing the use of other platforms.

43. In this regard we have reservations to the analysis of Professor Vogelsang in this context and in particular his final conclusion. First of all, Vogelsang clearly underlines that upwardly biasing UCLL and UBA prices by the Commission (e.g. based on Section 18 considerations) would generate significant welfare losses and would unlikely promote competition for the long-term benefit of end-users. Such negative effects would accrue for a long time. We share this view. On the other hand, Vogelsang assumes positive welfare effects of an UCLL price increase due to a forced migration to UFB fibre networks. Without providing any proof Vogelsang claims that positive network externality effects of a UCLL price increase for UFB subscribers exceed the negative externalities on copper-based services. For us it is basically an empirical question whether this relationship holds or not. This analysis has not been conducted by Vogelsang or anybody else, at least as far as we can see.

44. Without making this an explicit recommendation Vogelsang's final conclusion – which we expressed our doubts upon – invites the Commission to biasing the UBA and the UCLL prices upwardly to get access to the positive externalities of the UFB. In any case, it is an attempt to justify such a pricing approach. Its instrumental logic would be to incentivize a forced migration approach towards using access over the UFB fibre networks. It would be a critical implication of such an approach that consumers with "average" broadband demand would be urged to cross-subsidize consumers with ultra-fast broadband demand. Users at the lower end of the demand for telephony and broadband quality would then subsidise users at the higher end of the quality chain.

45. The Commission has not revealed in its consultation paper whether it shares Vogelsang's (apparently 'unconducted' quantitative) analysis, or whether, or under what circumstances, it would follow Vogelsang's implicit recommendation if it were convinced that this is the right way to go, and if that would be a feasible approach under (current) legislation. It would be a rather far reaching approach to instrumentalize the UBA and UCLL pricing decisions under a TSLRIC costing approach and then deviate from TSLRIC prices in that respect.

46. Any pricing approach which intends to deviate from TSLRIC pricing for externality reasons in any case has to prove empirically that the welfare losses due to price increases of such a regulatory approach are dominated by such spill-over externalities. Not to be misunderstood: We have no doubts that such positive externalities exist. We only have not seen a relevant quantification of its amount in

the New Zealand context and an analysis which proofs that they are dominating the welfare losses due to price increases of UCLL and UBA.

47. Assume that positive externalities and spill overs for fibre-based networks do exist and assume further that they are at a magnitude which overrules the negative welfare effects of increasing UBA and UCLL prices. Even then it is not obvious that economic welfare and the long-term interest of end-users are best served by upwardly biasing UBA and UCLL prices. Any comprehensive analysis has to take the whole framework of the UFB fibre network system into account including the governmental subsidies to build the fibre networks and the fibre wholesale prices. Only such a comprehensive analysis allows meaningful conclusions whether it really is economically efficient to internalize fibre network externalities by distorting copper prices. There may be better ways of doing it. One way would be to determine a migration path including copper network switch-off. Furthermore, setting fibre access prices with differentiation by bandwidth in order to reflect different customer interests would also incentivize migration as well as the general level of fibre prices.

48. The ambiguity of the externality concept and the complexities of estimating externalities in a complex system of price elasticities and cross-elasticities is one of the reasons why regulators around the world usually have not followed wholesale pricing approaches which take care of price and cross-price elasticities like Ramsey pricing. Even in cases like mobile termination rates where the relevance of externalities was relatively obvious, nearly all regulators around the world are hesitant to include externality factors into their pricing formulas.

3 Mapping the local loop cost to services

49. The Commission (see ***para. 197***) seems to assume that its FTTH MEA model would not be able to produce separate costs for the UCLL and SLU services. For consistency reasons of network costs the following equation should hold:

UCLL = SLU + SLU passive backhaul cost.

The Commission does not define yet how to calculate the SLU backhaul costs determining the spread between SLU and UCLL costs (***para. 224.2***). Taking TERA's proposal to build a second model based on a FTTN network in addition to the FTTH model into account, we propose the following calculation approach:

Case a) FTTN MEA costs ≤ FTTH MEA costs

In this case, the Commission plans to use the lower FTTN MEA costs following TERA's recommendation (***para. 180***). This FTTN MEA model includes cabinets and MDFs so that the costs for SLU and UCLL and their spread can be directly calculated. As SLU lines are available at active and passive cabinets, all SLU lines should be considered in the FTTN model for calculating the average SLU line costs.

Case b) FTTN MEA cost > FTTH MEA Cost

Following this case it has to be discussed, if the "subtraction" arithmetic proposed by the Commission is adequate. Results of a FTTH MEA model are the costs for a fibre network. A pure subtraction (UCLL - SLU passive backhaul cost) does not take into account, that the result of a FTTH MEA model are costs for a fibre network, which are lower than those for a copper network. If the costs of a FTTH are significantly lower, the result could be, that after subtracting SLU backhaul costs, SLU costs move towards zero or result – at least in theory - in a negative value. Considering this possible outcome, an alternative approach would be to transfer the relative cost difference between SLU and UCLL of the FTTN MEA model to the FTTH costs in order to spread the fees.

This would lead to:

SLU costs = FTTH MEA model based UCLL costs * (FTTN MEA model based SLU costs / FTTN MEA model based UCLL costs)

50. It is common international practice to follow an aggregated approach as the Commission defines in ***para. 205*** for calculating the same price for access between end-users and the exchange, irrespective of whether the line is cabinetised or non-cabinetised. Therefore, we support this approach conceptually. Otherwise, individual characteristics of each line would have to determine its price. Costs differ according to the physical characteristics of each individual line. Relevant business

and regulatory categories, however, cannot be based on a line-by-line approach but always rely and have to rely on relevant degrees of aggregation.

51. The issue of aggregation of cabinetised and non-cabinetised lines necessarily needs an approach to identify the number of cabinetised and non-cabinetised lines. The Commission does not specify how this issue of aggregation is going to be solved. Will the Commission use the current distribution of lines or will it use a distribution of lines based on the efficient determination of cabinetisation? According to the Commission's guiding principle to derive TSLRIC costs from an efficient network structure, it should be the distribution of lines based on the efficient determination of cabinetisation which should be used here.

52. In considering relativity concerns regarding SLU and UCLL prices as expressed in ***para. 213*** the Commission should take into consideration that SLU-based competition is highly unlikely in the New Zealand environment. Given the availability and the deployment of UFB fibre networks it would be mostly rational for RSPs to provide high-speed broadband access over the fibre networks instead of investing in SLU access for those customers which demand highest speed broadband access.

53. We want to highlight that the consistency conditions the Commission has formulated in ***para. 224*** only hold if SLU backhaul costs are calculated on the basis of its FTTN TSLRIC model considering just the passive network elements. SLU backhaul prices reflecting Chorus' actual cost (***para. 224.7***) would not meet the consistency requirements.

4 Key inputs to TSLRIC model

4.1 Demand

54. It is the logical consequence of the Commission's MEA approach to consider 100% of all fixed-line access connections as the relevant demand for calculating UCLL costs. Reference point is a hypothetical efficient operator which covers the whole access line demand in New Zealand. Only considering Chorus' copper access lines would not be consistent with such a MEA approach and the intended valuation approach of assets. Any migration or ramp-up which TERA (p. 56ff) discusses is conceptually misguided and would not be consistent to the MEA approach.

55. Another implication of this conceptual starting point is that the Commission cannot limit demand on the "current connection volume of Chorus lines" (***para. 229***). There is already some migration of lines ongoing to other operators. These lines have to be included in the total demand base.

56. "Current connections" should not be limited to access lines used for the UCLL, UBA and UCLF services. The relevant demand should include the access lines of any other service including leased line, bounded line and special data access line services.

57. The concept of active lines (***para. 229***) which should be the basis for allocating cost needs more specification. If it would mean or be limited to Chorus' currently active lines in its copper network, this would not be consistent and correct. In a bottom-up modelling context there should in principle not be a difference between the volume of demand, which drives and determines the dimensioning of the network and the volume of demand which bears the costs. Chorus' currently active lines do not include connections which have already been migrated to fibre. These connections should definitively be part of total demand. The Commission should justify and give proper reasons whenever it wants to deviate from the total connections (or total demand) as the relevant basis for allocating costs. There should in principle be no difference between the number (and structure) of access lines which inform the dimensioning of the access network and the number of access lines which bear the cost.

58. We are in agreement with the Commission's view on the demand for UBA (***para. 241, 245***). The second option of TERA assuming an EEO and considering the marginal MDF to be accessed for physical unbundling should be excluded. We are convinced that it is impossible to determine such an MDF, since each operator will have its own view, determined not only by cost-based arguments but also by others, like completing an area or a city, or in order to expand its network from the already existing coverage, Specific for New Zealand also is, that the largest operator based on UBA, Telecom NZ, does not unbundle at all at the present time.

4.2 Depreciation

59. The Commission proposes to apply the tilted annuity approach to determine both depreciation and the return on capital. WIK conceptually supports this approach with an adjustment factor for both expected price and demand changes. The proper application of the (adjusted) tilted annuity approach does not require a stable demand over time to be applied. It is only that the tilted annuity approach with an adjustment factor ("a tilt") for demand changes relies on a stable demand profile. Below is a detailed discussion of the implications of the two types of adjustment factors.

60. In the most general formulation, the annuity approach consists of a formula as follows:

$$I_0 = \frac{A_1}{(1+WACC)} + \frac{A_2}{(1+WACC)^2} + \cdots + \frac{A_n}{(1+WACC)^n} \quad (1)$$

where I_0 represents the initial investment at time 0 and the A_t, t =1, 2, …, n, represent the amounts of amortization to be realized by the asset in the n periods of its economic lifetime. If there were no tilt to be applied, all the A_t would by definition have the same value which it would be easy to determine from the standard annuity formula as below:

$$A = c * I_0 \quad (2)$$

where the capital recovery factor c is derived as

$$c = \frac{WACC}{\left[1-\left(\frac{1}{1+WACC}\right)^n\right]} \quad (3)$$

61. Since, however, a tilted annuity – whether simple or adjusted – is to be used, we need to consider how this tilt is to be implemented. Since equation (1) gives no clue to how this should be done, we need to express the formula in more detail, i.e.

express the A_t as the product of a quantity of service delivered by the asset times the price[5] for that service:

$$I_0 = \frac{p_1 Q_1}{(1+WACC)} + \frac{p_2 Q_2}{(1+WACC)^2} + \cdots + \frac{p_n Q_n}{(1+WACC)^n} \quad (4)$$

In the above formula, the components to which the two sorts of tilt would apply, p_t and Q_t, are separately identified. We deal with each of the two components below. (The WACC is not a subject of interest in the present context, so we do not consider it here).

62. The volumes of services, Q_t, expected to be provided by the asset in each of the n periods must be estimated on the basis of forecasts, where these forecasts may in principle be distinct numbers for each of the periods (assuming that the corresponding detailed information is available), or be derived on the basis of a formula incorporating some general information about the development of volumes over the relevant future periods (see further below). The point in respect of Q_t is that the values to be used in the above formula must be based on available information or forecasts.

63. The p_t stands for the "price" of the services provided by the asset (its cost in the TSLRIC context). It is the variable that has to be calculated. Multiplied with Q_t, as shown in equation (4), it determines the amounts of amortization (or depreciation[6]) of the asset over its lifetime. Now, evoking again the case of no tilt for the p_t and assuming, as discussed in the preceding paragraph, that the Q_t are known, we would obtain a constant $p_t = p$, which could easily be derived from equation (4) by an iterative procedure. Now, if a tilt is to be applied, it is usually expected that the price p_t of the asset's services are expected to change over time and this is to be expressed in the formula. One usually assumes a constant average expected price change, Δp, so that the value of the p_t in the periods after period 1, i.e. for t = 2, 3, …, n, equals $p_1(1+\Delta p)^{t-1}$. Inserting this expression into equation (4) leads to the following tilted version of the annuity formula:

$$I_0 = \frac{p_1 Q_1}{(1+WACC)} + \frac{p_1(1+\Delta p)Q_2}{(1+WACC)^2} + \frac{p_1(1+\Delta p)^2 Q_3}{(1-WACC)^3} + \ldots + \frac{p_n(1+\Delta p)^{n-1} Q_n}{(1+WACC)^n} \quad (5)$$

Equation (5) implements the simple (not adjusted) version of the tilted annuity methodology. If it is assumed, as the Commission seems to be doing, that demand

5 The "price" p_t as it is used here must be understood to be a component of the price of the final service delivered to the user, where this service will have been produced by a number of production factors, of which the asset considered here is just one, each factor having its own "price" in the sense considered here.

6 When referring to $p_t Q_t$ as amortization, we focus on the positive revenue generating aspect involved in using the asset. When referring to it as depreciation, we focus on the negative aspect of the loss of value of the asset due having been utilized for producing output. When using the term depreciation, we also mean costs; when using the term amortization, we mean required revenues to cover these costs. In the annuity approach, the values of the two coincide.

is stable, this amounts to Q_t being constant at a value of Q so that equation (5) becomes

$$I_0 = \left\{\frac{p_1 Q}{(1+WACC)} + \frac{p_1(1+\Delta p)Q}{(1+WACC)^2} + \frac{p_1(1+\Delta p)^2 Q}{(1+WACC)^3} + \cdots + \frac{p_1(1+\Delta p)^{n-1} Q}{(1+WACC)^n}\right\} \quad (6)$$

$$= p_1 Q \left\{\frac{1}{(1+WACC)} + \frac{(1+\Delta p)}{(1+WACC)^2} + \frac{(1+\Delta p)^2}{(1+WACC)^3} + \cdots + \frac{(1+\Delta p)^{n-1}}{(1+WACC)^n}\right\} \quad (7)$$

Using the standard transformation of equation (7) into the "short-hand" formula for the amount of amortization in the first period, we obtain the following equation:

$$A_1 = p_1 Q = c_1 I_0 \quad (8)$$

where

$$c_1 = \frac{WACC - \Delta p}{1 - \left[\frac{1+\Delta p}{1+WACC}\right]^n} \quad (9)$$

64. Equation (9) is the capital recovery factor for the first period when the asset is valued at p_1. For the following period the capital recovery factor, c_2, would be obtained by multiplying c_1 by (1+Δp). Note that when no tilt is applied, which means that Δp = 0, equation (7) collapses into equation (3). If, however, Δp is expected to be positive, the value of c_t , and with it A_t, starts with a relatively low value in period 1 but then increases each year in step with the expected average price change Δp. The opposite holds when Δp is negative. Therefore, a tilt due to expected future price changes backloads amortization if the expected average price change is positive, and frontloads amortization if the expected average price change is negative.[7]

7 From a technical point of view, note also that when one is only interested in the amounts of amortization for the n periods of the asset's economic lifetime, which is normally the case, it is sufficient to know – besides I_0, the amount of investment into the asset; n, its economic lifetime; and the WACC – the estimate of the average price change Δp. For implementing the tilt due to expected price changes, there is no need to know the value of the constant Q and the initial value of the price p_1. This is also evident from examining equations (7) and (8) in the text. The decomposition into p_t and Q_t was made for analytical reasons, to be able to exactly show how the tilt due to expected price changes comes about.

65. As regards the adjusted tilted annuity, it applies when expected future changes in the volume of services are to be taken into account. Above, we assumed that the individual volumes Q_t of service by the asset for each of the n periods might be known so that they could directly be inserted into the annuity formula, such as in equation (5). Also, if the Q_t are not known but the determinants of their development over time, they could be estimated by an appropriately specified function, such as the logistic function, and these estimates could then be inserted into the annuity formula. In these cases, however, there would be no “short-hand” formula for the capital recovery factor c_t such as expressed by equations (3) and (9). The determination of the initial price p_1 from equation (5) would then have to be carried out by an iterative procedure.

66. An approximate specification for the adjusted tilted annuity would consist in assuming an average growth rate g which could be integrated into the simple tilted annuity formula. Instead of the individual Q_t as in equation (5), the Q_t are defined in terms of the initial volume in period 1, i.e. Q_1, and the average growth rate, i.e. $Q_t = Q_1(1+g)^{t-1}$, where g stands for the average growth rate. It is thus assumed that the volume of services growth over the relevant period by a constant growth rate. This formulation is an approximation, since it assumes that the volume of services increases by an amount that is larger in absolute terms for each successive period.[8] So it must be used with care and given a value in a way that the total volume of services expected to be provided by the asset over its whole lifetime is approximated. If this approach is used, equation (5) becomes

$$I_0 = \frac{p_1 Q_1}{(1+WACC)} + \frac{p_1(1+\Delta p)Q_1(1+g)}{(1+WACC)^2} + \frac{p_1(1+\Delta p)^2 Q_1(1+g)^2}{(1+WACC)^3} + \cdots + \frac{p_1(1+\Delta p)^{n-1} Q_1(1+g)^{n-1}}{(1+WACC)^n}$$

(10)

67. For an easier reading of equation (10), the reader is invited to consult again equation (4) in which the individual values for p_t and Q_t appear, and imagine that p_2 to p_n and Q_2 to Q_n are now defined as functions of p_1 and Δp and of Q_1 and g, respectively. In any case, from equation (10) the short-hand formula for the capital recovery factor for the first period can be derived as

$$c_1 = \frac{WACC - \Delta p - g - \Delta p g}{1 - \left[\frac{(1+\Delta p)(1+g)}{1+WACC}\right]^n} \quad (11)$$

68. The effect of a growing volume of services that is provided by the asset, amounting to an increasing rate of its utilization over time, does not lead to a price that changes

8 In the TERA report for the Commission, a similar observation is made (p. 61). The author suggests that using a logistic curve for forecasting expected future levels of demand would be more appropriate. This corresponds with the earlier observation made in the present text. TERA, however, does not comment on the fact that this approach would complicate the determination of the capital recovery factor through which the amortization/depreciation of assets is determined when applying the TSLRIC methodology.

over time. The effect of the growth in volumes is rather that it decreases the overall level of the price relative when there is no growth; i.e. p_t becomes smaller for all t (while the profile of its development over time continues to be determined by the expected average price change Δp). The reason is that with growth in volume the initial investment I_0 is distributed over a larger number of units of service than if there were no growth. Larger volumes in the future backloads amortization.

69. As a conclusion, WIK strongly supports the use of a tilted annuity approach with an adjustment factor for both price and demand changes. For the determination of the cost recovery factor we recommend the use of equation (11).

4.3 Modelling basis for taxation

70. The Commission proposes a pre-tax TSLRIC that takes into account the fact that under New Zealand tax laws the tax value of assets may not be revalued in contrast to the TSLRIC methodology for which assets are valued at current prices. Therefore, the adjustment to the TSLRIC formula for the corporate tax is modified from what it would be without this special proviso.

71. It appears that for this purpose the Commission intends to apply an adjustment to the capital recovery factor (referred to by the Commission as “annuity factor”) as derived by equation (11) above, as follows:

$$c_{ta} = c\left[\frac{1-\frac{td}{d+WACC}}{1-t}\right] \tag{12}$$

where c_{ta} stands for the tax-adjusted capital recovery factor, t is the corporate tax rate and d is the diminishing tax depreciation rate for the asset in question. It is not objectionable to incorporate in the formulae leading to the TSLRIC the special treatment of asset values by the tax laws. The approach proposed by the Commission appears to be unusual, however. Since corporate taxes impinge on the return on equity capital, it is common practice to apply the adjustment for taxes to this component in the WACC, most commonly in the following form:

$$WACC = \frac{w_e r_e}{1-t} + (1 - w_e) r_d \tag{13}$$

where $(1\text{-}w_e)r_d$ is the component on account of debt holders and $w_e r_e/(1\text{-}t)$ is the component on account of equity holders, to which the adjustment for taxes is applied through the division by (1-t), t being the corporate tax rate. If then an adjustment is to be made to account for the particular valuation rules prescribed by the tax laws, we feel that this adjustment should be made in a formula like (13), applying it to the component of the WACC that is in fact subject to this tax.

72. Given that the approach proposed by the Commission in attachment A is not clear to us, and requires more explanation we reserve further comment until greater transparency into the proposed approach has been established.

4.4 TSLRIC price profile for UBA and UCLL services

73. The Commission states that its preference is that a constant TSLRIC-based price of an end-user service will to a large extent be composed of amounts of amortization/depreciation that reflect the utilization of network elements (assets) for the production of this service. As shown in the discussion regarding depreciation, when a tilted annuity approach is applied (see equation (9)) above, the amounts of depreciation change from period to period in step with the expected changes in the prices of the network elements. It follows that the prices based on these cost components will also have to change from one period to the next.

4.5 Cost allocation

4.5.1 Definitions of service and cost categories (para. 261 – 273)

74. This part in the Commission's document is mostly preliminary to the issues discussed in the following paragraphs on actual cost allocation rules. It includes, however, a number of statements that require commentary.

75. In ***para. 262***, in respect of the proviso in the Telecommunications Act that TSLRIC should include a reasonable allocation of forward-looking common costs, the Commission states that "(w)e interpret 'reasonable' to be a level of cost between stand-alone and incremental cost". This view of TSLRIC is in our view highly ambiguous. The use of the term 'incremental' in the statement means 'directly attributable' (as becomes clear in ***para. 271***) which could mean that a large portion of costs is considered shared in the sense that for this portion cost drivers could not be identified, which in turn would mean that rules for common costs have to be applied. This view is not consistent with a TSLRIC view which determines the cost for a *total service increment* as a function of the capacity of this increment, treating in this process all production factors as variable. The cost of a component service contained in the total increment will then be proportional to its share in the increment. When discussing concrete approaches farther down in the document, the Commission in part adheres to such a view, nevertheless it also appears to consider that a substantial part of network cost is shared in the sense that cost allocation rules not based on identifiable cost drivers are required. We will treat this issue in detail when discussing below the Commission's various approaches to the allocation of network costs.

76. The discussion in the following paragraphs further deals with the difference between directly attributable and shared cost. From this discussion, it seems to follow that hardly any cost of a service could be considered as directly attributable and most would be shared, with the consequences mentioned above. In ***para. 273***, the Commission defines ‘network costs’ and ‘non-network costs’ as the cost categories that it will use. As we will see below, its treatment of non-network costs is acceptable. In respect of ‘network costs’, the wording again emphasizes the view that these costs encompass common network elements while there is no mention any drivers of such costs.

77. What makes the Commission’s view on TSLRIC somewhat difficult to assess is that it does not clearly follow from the Commission’s arguments what ‘identifiable’ cost drivers are. It appears that in order to fit this perception, one should be able to ‘see’ that a particular type of hardware is used directly and exclusively for a particular service, so that the volume of this service can directly be related to the usage of this type of hardware. In contrast, when in other jurisdictions TSLRIC is applied, one looks at the total service increment and asks how that increment drives the total size of the network. With bottom-up modelling one is then in a position to show the causal relationships between variations in the size of the total service increment and variations in the size of the network, these relationships expressing the effect of concretely identifiable drivers of the cost of that network. Since in general any particular service segment contributes to the size of the total service increment the same as any of the other service segments, each and all of these service segments are equally drivers of that costs so that they have to bear that costs in an equal fashion. As will be pointed out below, the Commission seems in a number of cases to apply this philosophy, despite its arguments what identifiable cost drivers may be.

4.5.2 Concrete cost allocation approaches (para. 274-281)

78. Despite the Commission’s view commented on above as to which costs are directly attributable and which are shared, the rules that it suggests for network cost on account of UBA and partially also for network cost on account of UCLL could as well be derived from a more common interpretation of TSLRIC and what are relevant cost drivers. This holds when in Table 2 for UBA it proposes the use of input-based and output-based indicators, and in Table 3 for UCLL the use of capacity-based indicators. These rules, as argued in more detail in paragraph 72 below, essentially all amount to output-based allocation of cost, which is the rule that WIK-Consult recommends for all network costs.

79. The output-based approach essentially corresponds to what is commonly used in most cost models for distributing (shared) network costs to the various services. The input-based approach is in our view an output-based approach in disguise.

This becomes clear when considering the example given in Table 2 according to which the cost of civil engineering is allocated on the basis of the numbers or sizes of cables running through the ducts. Cost allocation in bottom up models often involves allocation of costs to intermediate outputs before the latter's costs are then allocated to final (wholesale) products. In the example, the intermediate output is the usage of ducts by cables to which the cost of the civil engineering are then allocated according the relative duct space they occupy. The cost allocated to the cable (here as 'output') is in a later stage allocated (then as input) to services such as 'UCLL', 'leased lines' or 'conveyance of data', on the basis of relative use of these cables. Also the capacity-based approach, included in Table 3 as one of the candidates for cost allocation for UCLL services, falls into the category of acceptable allocation rules. As correctly stated by the Commission, it is the approach used in most bottom-up LRIC models.[9] It is closely related to the output-based approach. Thus, despite its somewhat opaque discussion of the properties of the TSLRIC methodology, the majority of the Commission's allocation rules appear to be in line with international best practice. The approach for which this does not hold, the one that is in glaring contradiction to international best practice, is the Shapley/Shubik method included in Table 3 as a candidate for the network cost not directly attributable to the UCLL and other access services. We reserve the next section for a detailed critique of this approach.

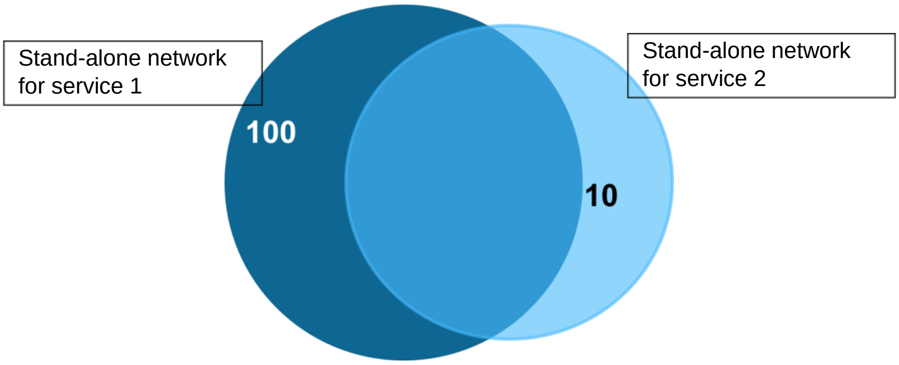
80. For non-network common cost, the Commission proposes in Table 4 the equal proportionate mark-up (EPMU) methodology. This approach is common practice in bottom-up LRIC cost models and is fully supported by WIK.

4.5.3 The Shapley/Shubik method (Table 3)

81. The way the Shapley/Shubik method works is demonstrated in the report that Analysys Mason prepared for Chorus. In that report the substantial complications that arises when the approach is applied in the face of any moderate number of services, in particular in terms of computer time for running the cost model, is pointed out. In the present section, the Shapley/Shubik method is analysed using an example involving only two services that nevertheless is able to highlight the very particular aspects of it and its critical implications on proper cost causation allocation, the TSLRIC methodology and its efficiency implications.

9 The Commission appears to draw a distinction between output-based and capacity-based approaches. Both are actually output-based. In both cases, the cost of a network element, of its capacity, is allocated to services according to the relative use of this element, of its capacity, by these services. The distinction would make sense if the cost of a network element is allocated according to shares of capacity that in some sense are only 'reserved' for a certain usage without assurance that the capacity is actually utilized. The wording in Table 3, however, makes clear that this is here not the case.

82. Consider the figure below. The two circles represent two networks each producing a different type of service. The size of each circle represents the size of the corresponding network; the numbers inside each circle represent the volume of the service provided by that network. Note that while the left network might be 50 % larger than the right one, it produces a volume which is ten times as large as that of the smaller one. Note also the large overlap of the two circles which indicates that the two services use a lot of similar infrastructure. Thus, if one had only one network producing both services together, the size of this one network would correspond to the merged two circles causing in sum a total cost which is substantially less than the sum of the two stand-alone costs.



If we now turn to the allocation of costs under the Shapley/Shubik method, this would be as follows:

- For 100 units of service 1:

  Average of the

  - cost if the 100 units are produced stand-alone with the left network, say 150 units of money, plus the
  - incremental cost if the right network is set up first and is then enlarged with capacity to also provide the 100 units of service 1, say additional 50 units of money, meaning
  - A total cost of units of money.

This implies an average of 100 units of money and a cost per unit of 1, instead of 1.5 as in the case of stand-alone production.

- For 10 units of service 2:

  Average of the

- cost if the 10 units are produced stand-alone with the right network, say 120 units of money, plus the
- incremental cost if the left network is set up first and is then augmented with capacity to also provide the 10 units of service 2, say additional 80 units of money, meaning
- again a total of 200 units of money.

This implies an average of 100 units of money and a cost per unit of 10, instead of 12 as in the case of stand-alone production.

83. Now consider in contrast the cost per unit that would arise under an allocation according to the relative intensity of use by the two services of the combined network. Assuming that the units of the services have comparable dimensions, we have a total cost of 200 divided by 110 units leading to 1.82 per unit. This – admittedly simplified and overdrawn – example shows why the Shapley/Shubik cost allocation method might be favored by incumbent operators. If it so happens that service 2 is the more lucrative service and service 1 is the service with a large volume but low revenue per unit, if service 2 is regulated and service 1 is not, and if then the capacity for service 2 is to be unbundled to be made available to competitors, then it is quite obvious that incumbent operators should prefer Shapley/Shubik since under the given circumstances it would provide for a substantial higher regulated price for the regulated unbundled service. The example illustrates the general feature of the Shapley/Shubik method that when the volumes of the services, the costs of which are to be determined by that method, vary a lot, the resulting cost of the service with the smallest volume will get the relative largest share of total cost allocated to it. It is therefore not surprising that the Shapley/Shubik approach is particularly controversial in the case of such largely diverging volumes of services.

84. In any case, the approach is not compatible with the competitive standard that regulatory authorities are generally expected to advance. The competitive standard assumes an efficient new network operator that enters the market under competitive conditions and erects a network comprising capacities for all services (in our examples both service 1 and service 2). Whenever this operator plans to enter a particular area, he/she asks what capacities are needed to meet the demands of potential customers in this area for all of the relevant services; she/he does not ask what locations do I need to first provide only service 1, which locations do I need to first provide only service 2, and then how many locations do I need to provide the two services together. Since future customers will potentially demand all services, the rollout will be driven by the sum of potential demands for all of these services. Given the known demands on capacity by the various services, it is obvious that the service demanding the largest share of capacity (in the example service 1) will also be the more important driver for the rollout than the smallest

service (in the example service 2). This should also be reflected in the rules according to which the costs of the networks are to be allocated. The allocation according to relative shares of output (as actually proposed by the Commission for UBA) would be the appropriate approach.

85. The Shapley/Shubik method proceeds on the assumption as if the two services were two players that deal with each other at arm's length and then find this game-theoretic approach as the appropriate one to find a solution. It seems odd that one should look this way at services provided by the same operator. But let us assume for the moment, using again our two-service example above, that the two services are offered by two separate providers, a provider of service 1 and a provider of service 2, and that the volume relationships are such as in this example. Assuming the common infrastructure as in the example and assuming that cost allocation is undertaken according to Shapley/Shubik, the provider of service 1 would face substantially lower cost per unit of service than the provider of service 2. It follows that the provider of service 1 would find itself in a position to invade the market of the provider of service 2 with a price substantially below that of that provider. Service provider 1 would by means of Shapley/Shubik cost allocation have been provided with significant market power which obviously conflicts with the regulatory objective of competitive market conditions of a "level playing field". By creating the potential for cross subsidization, the Shapley/Shubik method contradicts the fundamental idea of the efficient service provision. To prevent this potential, the proper method for allocating the cost of the shared infrastructure is according to its relative utilization by the various services, most appropriately on the basis of relative output shares.

86. It is for these reasons and implications that all regulatory authorities – as far as we know – which have considered the Shapley/Shubik allocation methods have in the end rejected it. This also holds as far as we know also in the case of Denmark which the Commissions mentions in ***para. 280***.

5 Issues not yet addressed in the consultation paper and the need to develop a model reference document

5.1 Issues not yet addressed in the consultation paper

87. We are sure that the Commission is aware that the sharing of network elements is a key element of structuring a network and to build a network in an efficient way and at efficient cost. The Commission will also be aware that the sharing of network elements had played a significant role in network deployment in the past as well as at present. Sharing has a major impact in particular on the cost of civil engineering infrastructure but is not limited to it. The consultation document is not addressing sharing and the various levels and forms of it in the relevant detail.

88. In the following we will briefly describe the possible forms and levels of the network where sharing may occur. We will also give some examples how sharing has been dealt with in a cost model context.

89. Sharing can be classified in:

1. Internal sharing of trenches and ducts within the same Telco business

   (a) Within the same network level: The same trenches/ducts/poles will be shared between the feeder and distribution segment of the access network. Also feeder fibre in case of FTTN may share the infrastructure of the copper distribution network segment.

   (b) Between different network levels: The access, aggregation and core network segments will typically share the same trenches and poles wherever economically feasible.

   (c) Between different services: Not only mass market access services should be considered, but also dedicated enterprise customer services like leased lines, mobile backhaul or dedicated data services etc. have to be taken into account and share the cables or ducts/trenches of the access network and are part of the access demand. Fibre and copper lines at least will share duct/trenches or poles.

2. External sharing of trenches and ducts between separate operators of same and different business:

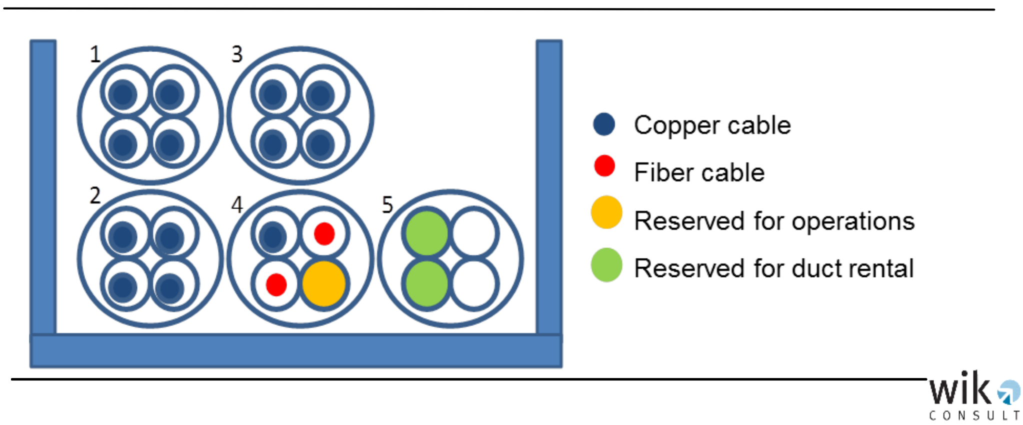
   (a) Between different telecommunication operators: At least Telecom NZ and Chorus share trenches, but there are also efficient options of sharing between other operators at least in those (dense urban) areas, where these are active.

(b) Between signalling or telecommunication networks of public infrastructure providers: Many public authorities, public transport enterprises, operators of highways and waterways etc. operate their own telecommunication network between or within their assets (e.g. for traffic lights, public lightning, highway control, public transport incl. railways, …)

(c) Between trenches of other utilities providers: Typically the other utility providers (power, gas, water, sewerage) also operate their network in underground pipes or via aerial infrastructure. Thus, these ducts/ trenches or poles can be shared efficiently. In addition, in many cases they operate own separate service delivery control telecommunication networks, in which also (fibre) cables and ducts/trenches or poles may be shared.

90. Some examples of sharing may illustrate how this can be included into cost modelling:

a. The cost of ducts and trenches can be allocated according to the space consumption by the cost bearers copper, fibre and wholesale ducts



Source: WIK/CMT (now CNMC)[10]

The investment of civil engineering infrastructure is shared according to the number of copper (blue), fibre (red) and wholesale subducts (green). The investment for operational spare (yellow) and unused spare ducts (white, due to indivisible duct sizes) is distributed between the cost bearers accordingly. The shares of duct use are calculated endogenously within the Spanish cost model[11] according to demand. The demand for copper pairs and copper cables of given sizes is calculated bottom-up street by street according to the copper

10 Plückebaum, T., Analytical cost model for copper fibre overlay – applied to the access network in Spain, 1rst IRG Capacity Building Workshop on NGA, Frauenfeld (Warth) (CH), 14.-17. April 2014

11 See footnote **10** and the link to CNMC (former CMT): http://www.cmt.es/ver-documento?&articleId=3175085

line demand distribution within each building. The cable demand defines the subduct demand. In the same manner the fibre overlay cable demand is calculated and results in subduct demand for the fibre cables. Operational spare subducts are added according to parameterization and then also wholesale subduct demand is added according to the wholesale duct demand defined as model input. In consequence all subduct demand is defined and forms the duct demand per street, which in a next step determines the trench size. The duct demand per street may result in some spare subducts due to indivisible duct sizes (see white circles in the figure above). The total cost incl. the cost for operational spare and other spare subducts is then allocated to the services (copper access, fibre access, wholesale duct demand) according to the number of subducts they occupy.

b. The common use of trenches by fibre and copper cables may be considered as separate subducts for fibre or copper (see a.) or by summing all connected copper pairs and fibre lines and dividing the trench cost by the sum of all active copper and fibre lines. Such approach has been chosen by the French regulator ARCEP in order to make the trench cost allocation to copper and fibre access lines independent from the state of migration.[12]

c. The degree of common trench use between feeder and distribution segment is endogenously determined by the cost model (e.g. in Germany[13], Austria, Switzerland, Spain, …). The degree of common use between different network levels can be determined endogenously out of a cost model if it also covers the aggregation and core network and its efficient optimization of trenches based on a geodata processing. An alternative might be to ask the operators in the market for their experience and for appropriate sharing factors (investment reduction factors).

d. Sharing of trenches (or poles) can be considered in the model by reducing the trench investment by a reduction factor. E.g. the German NRA has published a guideline for cost sharing between power and telecommunications networks[14] describing a cost distribution of the trenching cost of the commonly

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12 See ARCEP decision 2010-1211 of 9 November 2010; http://www.arcep.fr/uploads/tx_gsavis/10-1211.pdf

13 Bundesnetzagentur has only published early versions of the model documentation on its website. http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Marktregulierung/Massstaebe_Methoden/Kostenmodelle/Anschlussnetz/AnalytischesKostenmodellAnId264pdf.pdf?__blob=publicationFile&v=3, the Swiss and the Austrian NRA use models of the same family

14 BNetzA, Leitfaden: Mitverlegung von Glasfaserkabeln oder Leerrohren für den Telekommunikations-breitbandbetrieb, 2012: http://www.bundesnetzagentur.de/DE/Service-Funktionen/Beschlusskammern/Beschlusskammer8/BK8_93_Leitfaeden_und_fSV/BK_Energie-Leitfaden_2012_download.pdf?__blob=publicationFile&v=1

constructed infrastructure, thus ensuring no cross-subsidies between the power and telecommunications business.

91. At the stage of modelling, the Commission should not exclude any possible form of sharing network elements. The model to be developed should be constructed to be flexible enough to include and to deal with any (relevant) form of sharing of network elements. The actual amount and degree of sharing shall then become a matter of populating the model with the appropriate parameters.

92. Neither the Commission's consultation paper nor TERA's report is dealing with data sources which will be used to manage the basic data set up. Thus, we wonder, if the access network will be deployed along the streets (best practice) and which street data will then be used, or which other basic data can be used to route an efficient access network. While the MDF locations are requested from the network operators it remains unclear to us how the other access network endpoints at the end customer sites come into account and how access line demand is allocated to them.

93. According to our experience and best practice access line demand could be allocated in the area by using the geo-coordinates of each existing endpoint, or the demand per MDF location could be distributed to the buildings in a randomized manner. Since we did not observe questions about the endpoint distribution within the data request[15] this point remains unclear.

94. The Commission has asked in its data request directed to the network operators for all their MDF sites and their access areas, but has not yet revealed whether the model will be covering the whole network, MDF area by MDF area or whether it will be based on a sampling approach of "representative" MDF areas. In the latter case the Commission should reveal its considerations why a sampling approach would be more appropriate than a full network approach. Furthermore, in this case the Commission should also make clear which geotype approach it would choose to select "representative'" MDF areas and how it would aggregate individual MDF results to a result which would be representative for New Zealand on a nationwide basis. If a full data basis is available, WIK recommends to avoid sampling. To improve the quality and correctness of results e.g. the German regulator changed from a sampling methodology to a full data basis approach a few years ago.

95. The consultation paper basically deals with modelling network CAPEX. It is not addressing how the major cost component of OPEX (whether network nor non-network) and (non-network) CAPEX will be calculated in order to reflect TSLRIC. The consultation paper gives hints how to allocate such costs with a preference of

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15 Notice to supply information and documents to the Commerce Commission, Section 98(a) and (b) Commerce Act 1986, directed to Chorus, 17.4.2014 the Commission for a cost-driver-based allocation (***para. 261-288***). The Commission does not, however, describe how these costs flow into the model and how they will be modelled in detail. Will the Commission set up its own bottom-up modelling path to determine the relevant amount of OPEX and non-network CAPEX or will it leave these costs blocks be driven by (network) CAPEX, e.g. on the basis of relevant mark-up factors. The latter methodology is often but not exclusively applied in bottom-up models. The German regulator introduced a cost driver driven OPEX and non-network CAPEX costing approach and the result was a significant reduction of the previously applied mark-up factors. Moreover, TERA (p. 28) reports of significant differences between FTTH and FTTN networks OPEX related costs. As TERA also proposes the use of two network models, FTTH and FTTN, it is appropriate, to model these costs properly in order to identify the cost differences.

96. In the data request to Chorus[16] we could recognize that the Commission asked for OPEX regarding network and non-network equipment (6.19.3 and 6.19.4). How this will be reflected in the cost model remains unclear.

97. The consultation paper does not describe the demarcation points of the network. Thus, it is not clear where the UCLL network ends at the end-customer side. Is it at the edge of the street, or is it in a network termination point mounted on the outside façade of the building, does it include the inbuilding wiring up to the first CPE? Demarcation points are not only relevant in a technical sense. They also have relevance with regard to the questions who bears the cost for certain network elements, e.g. for the drop lines on the private ground or for the inhouse wiring. Typically NRAs located the demarcation point due to the specific national circumstances of the allocation of cost between the building owner or user and the access network operator. This is what we also recommend for the New Zealand model application. The model should either have choices for different modes or it should be defined and described in advance as to which mode(s) will be implemented.

98. Trench routing optimization is a key component for any efficient access network structure. The consultation paper leaves it open how trench routing will be conducted in the model, which algorithms will be used. While for copper networks with FTTN the sub-loops may be optimized due to shortest sub-loop length to the cabinetized DSLAMs, thereby maximizing the bandwidth for each end customer, for a FTTH Point-to-Point network the fibres might be concentrated due to strict minimum cost approaches. The optimization may then be performed i.e. by an augmented shortest path algorithm. Furthermore, it remains open if the trenches are planned to be on both sides of the street or on a single side, crossing the street

16 Notice to supply information and documents to the Commerce Commission, Section 98(a) and (b) Commerce Act 1986, directed to Chorus, 17.4.2014 for connecting the opposite homes, or if a cost optimization methodology improves efficiency.

99. The Chorus data request asks at 6.4 for mean measures of core asset geographic redundancy. The consultation document does not detail how to make use out of such information within the cost model.

100. The data request addressed to Chorus includes questions about trenching cost structured along the LRIS lithology classifications (surface types) and the related geo-database[17]. NZ soil information covering the underground (1-2 m) is collected in the NZLRI data base[18]. Thus, both trenching cost components, surface and soil classes, may be available in NZ databases. The Commission so far has not expressed if and how far it intends to make use of this information during the modelling process. Combining the trench route information with surface and underground information on the basis of geo-referenced data would allow for a high degree of objectivity and accuracy in the main cost driver for access networks, a high degree of data quality presumed.

5.2 Issues not yet specified to a sufficient degree of detail

101. The Commission's consultation paper is a major step forwards to identify key modelling principles and methodologies the Commission and its consultants are going to apply in developing the TSLRIC model. The level of detail as presented does, however, not allow to make the necessary consistency checks and to give input from the informed experience and view of market players. We regard this aspect as essential for an efficient modelling process. From our own modelling experience we know how difficult, time and resource consuming it can become if you do not get the structure of the network you want to model and the structure of the model right from the beginning and before you develop the model software. Having the need to make changes in basic elements of a model once the software has been fully developed, may jeopardize any timetable fixed in advance. A few examples may highlight the need for a more detailed specification.

102. Assuming the model is based on geodata processing in order to optimize trench construction between the end-customers and the MDF locations, then the result strongly depends on the locations of the customer endpoints of the access network and on the method determining the cabinet locations. Since geodata processing is time consuming, changes in the demand distribution of access line endpoints or in

17 https://lris.scinfo.org.nz/document/162-lris-data-dictionary-v3/
18 http://smap.landcareresearch.co.nz/smap#layers=text_cache_nztm,water,transport,text,topobasemap_notext,topo_hyb_relief,topo_mono_hyb_relief,smap_overview,topobasemap_monochrome_notext,landscape_eco_painted_relief,landscape_shaded_relief,coastpoly,smap_paw_1m,smap_depth,smap_soil_drainage,smap_polys_anno

the determination of cabinet (flexibility point) locations may have a significant impact on model delivery time. This also holds, if the engineering rules for designing the network assets, especially the trenches and ducts or poles, are subject to changes affecting the efficient result. Also a change in the optimization rules of the trench construction (least cost methods) would require a repetition of the time consuming geodata processing. Therefore, those fundamental engineering assumptions have to be addressed and consulted before the model software actually will be developed.

103. The method and degree of detail regarding depreciation and taxation to assets as a group or the option to treat each asset individually has impact on the modelling of the financial modules of a cost model. Thus, this should be consulted and defined in advance of the model implementation process.

5.3 Need to develop a model reference document

104. We clearly recommend to the Commission that it should develop and publish a model reference document which represents a high level specification of the model before the software of the cost model is finally developed and before the Commission is applying the model to calculate TSLRIC prices based on the model. Neither the Commission's consultation paper of 9 July 2014 nor TERA's MEA paper from July 2014 fulfils this function.

105. Only a model reference document provides the platform and opportunity such that network operators and RSPs can provide their knowledge and expertise of networking in New Zealand to the benefit of the Commission getting an appropriate and correct model in the end.

106. If the Commission intends to publish a model reference document only in connection with publishing its draft FPP and the model software itself, this opportunity to benefit from the expertise of network operators and RSPs no longer exists, and in any case it remains to a very limited degree. This basically holds for two reasons: Once the model, its population with parameters and the draft FPP is on the table, the Commission can no longer expect that market players bring in their network and cost expertise in an unbiased way. The second reason relates to the sunk cost of a fully defined and developed model software and its computation results. If the model is fully developed it mostly becomes rather time and resource intensive to change the basic structure of the model software and the basic data set it is built upon. Thus, the Commission faces the risk that some or in the worst case major parts of the sunk cost of model development become stranded investment. This would endanger the whole timeframe of the modelling and the FPP process. If the Commission does not feel in a position to change basic elements of its cost model it runs the risk of operating on the basis of an inappropriate model

and the strong risk that stakeholders challenge the Commission's FPP decision successfully before court. It is for those two reasons that regulatory authorities around the world publish and consult model reference papers before they develop their model software. It has proven to be in their best interest.

107. We understand from the RFP to engage a consultant that the Commission not only intended to publish both a model reference document and the Draft Model Specification and to consult those documents with the industry. These documents should have covered and set out all modelling parameters and inputs on which the TSLRIC model would be built. Such a process would likely be too time and resource consuming at the current stage of process. Notwithstanding, to abandon publishing a model reference paper at all would, however, not be appropriate.

108. Based on our judgment and experience, developing, publishing and consulting a model reference document must by no means jeopardize the published time table of the Commission. Any state-of-the-art modelling approach requires to write and fix (at least tentatively) a high level specification before the actual software development begins. The only exemption might be that the Commission has purchased a complete model from the consultant which will only be slightly adopted to New Zealand circumstance. We assume that this is not the case. For that reason we are convinced that a model reference document could be published quite soon after the ongoing submission and cross-submission process related to the consultation document of 9 July 2014. Thus, publishing the document and a workshop-type interaction with industry could in our view be fully in line with the current time table of the Commission and can be handled in September. We are used to present the modelling concept in detail after publishing a reference document with stakeholders and always regard this interaction rather fruitful for final model development. We invite the Commission to share this experience.

6 Regulatory period

109. A five year (or even longer) regulatory period is totally uncommon in Europe. The Commission mentions in ***para. 321*** that some European NRAs support a regulatory period of three years. Some others, however, apply a one or two year regulatory period for wholesale price regulation.

110. The Commission argues in ***para. 304*** that the length of the regulatory period is likely to be a trade-off between providing certainty and maintaining flexibility. Regulatory flexibility (or discretion) is not a value in itself. The more important criterion of considering wholesale price changes within a five year period follows the change of major cost drivers or parameters determining the cost model outcomes. As UCLL and UBA are planned to be modelled by an FTTH and Ethernet MEA approach, this modelling provides more input uncertainty like the old copper access networks. There is a relevant degree of technological progress to be considered in a five year period. If such parameters change to a relevant degree wholesale prices should follow for efficiency reasons.

111. Furthermore, the Commission should take care of consistency between its modelling approach and its choice of a regulatory period. As already discussed in Section 4.2, when a tilted annuity approach is applied, the amounts of depreciation change from period to period. This means a changing price depending on this changing cost component. Therefore, a constant price over a regulatory period of five years can be technically derived from a tilted annuity approach but it would not be consistent with the derivation of the costs on that basis.

112. For the reasons mentioned above we recommend to the Commission to keep its flexibility for wholesale price changes within a five year regulatory period if major cost drivers for the UCLL and UBA services in the cost model change to a relevant degree. To manage the trade-off against regulatory uncertainty, the Commission should make clear in its final FPP determination what would trigger and drive any wholesale price changes it may consider during the regulatory period.