WIK-Consult • Report

Study on behalf of the Federal Office of Communications (OFCOM)

Scenarios for a national optical fibre expansion strategy in Switzerland

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Management summary

1. Switzerland leads Europe in the transition to next generation access via VDSL. Today, some 75% of Swiss citizens can already obtain access to VDSL. Switzerland also plays a leading role in Europe in relation to FTTH networks, which according to current knowledge will bring the highest conceivable capacity levels in a communications network, and which are future-proof for the planning horizon of the next two decades. Given the central significance of fibre optic networks, in August 2009 OFCOM commissioned WIK-Consult to undertake an economic analysis and evaluation of the central issues affecting the development of fibre optics. The most important questions under examination in the study are as follows:

What level of FTTH network coverage can be shown to be profitable?
What investment requirements are associated with a comprehensive nationwide optical fibre expansion strategy?
What cost differences are demonstrated by the different FTTH network architectures?
What are the cost differences between a multiple fibre model and a single-fibre model?
What are the implications in terms of economic viability of fibre optic networks on a possible universal service obligation for fibre optic connections?
To what extent are fibre optic networks replicable by competitors?
What possibilities for competition are opened up by co-operation models and unbundling models?

2. In order to subject the abovementioned questions to an economic evaluation and to be able to prepare for economic policy decisions, we developed a modelling tool for OFCOM within the context of this project. The fibre optic network model has been developed for the specific conditions in Switzerland in terms of network configuration, distribution of the population and businesses plus the structure of conurbations. The fibre optic network model that we have developed enables OFCOM to illustrate and assess a large number of very varied scenarios in relation to national, regional and local FTTH network development. The model that has been developed not only allows OFCOM to provide information on a national basis for scenarios across the whole of Switzerland, but also allows conclusions to be drawn about necessary investments and profitable network expansion for cantons, towns and urban districts, right down to individual exchange areas.

3. The model approach adopted is based on bottom-up network modelling, according to which the long-term, incremental average costs for fibre optic expansion can be calculated whilst taking into

consideration a given demand. In this process, all elements of the connecting network (house connections, optical fibres, connection routes and interfaces) are taken into consideration according to the distribution of customers in the particular area. The model is essentially designed as a Greenfield approach, it assesses all the network elements required at current replacement value, i.e. as if they had to be purchased and installed now. Any network elements that happen to be available are estimated at the current replacement value, and network elements already written off are actually replaced by new ones. This also corresponds to the economic calculation of a company that is seeking to evaluate the profitability of an investment on the basis of its opportunity costs. Deviating from the pure Greenfield approach, where the locations of all network nodes are optimally situated, we take into consideration the existing Swisscom exchanges as fixed components of a network that is otherwise efficiently optimised, as so-called "scorched nodes".

4. The model determines the reach and profitability of fibre optic expansion on a cluster basis. To do this we assigned all 1,491 exchange areas of the Swiss network to a total of 16 clusters, depending on the respective density of connections per km^2. For each cluster we show the development of costs and revenue in the case of different market shares and thereby determine the cluster-specific critical market share that indicates when costs and revenue are balanced. The critical market share is necessary to cover all network costs and service provision in the particular cluster.

5. Our model calculations indicate that development of an optical fibre network to cover approx. 60% of the population can be shown to be profitable and cost-effective. In Cluster 10 (which is still just profitable), however, a network operator must achieve a market share of 75% to cover network costs based on a turnover of CHF 85 per customer per month, which we assume to be average. The development limit is lowered if fibre optic development uses the multiple fibre model instead of the single fibre model. This applies specially for a case where multiple fibres are extended as far as the local exchange.

6. The investment requirement determined by us increase monotonically as the cluster density falls, i.e. with reducing connection density in the particular clusters. They vary from CHF 1,980 for the single fibre model in the most densely populated cluster (7,000 or more connections per km^2) up to CHF 6,421 for Cluster 12, where there are only 150 connections per km^2. In the multiple fibre model, investment requirements increase by between 5% and 12% per connection if the network interface is at the distribution point. If the interface is in the local exchange, the investment per connection rises by between 10% and 26%.

7. If Swisscom can save 20% of trenching costs, because it is able to utilise existing cable ducting, this leads to savings in overall investment costs per connection of between 8% and 14% (in Cluster 12).

8. Development of a nationwide optical fibre network in Switzerland, with 75% of all households and companies connected, would require total investment of CHF 21.4 billion (single fibre model) or CHF 23.9 billion (multiple fibre model and access in the local exchange). The majority of the investment would be in rural areas of Switzerland, where fibre optic expansion would not be profitable for the network operators. This is demonstrated, for example, by the fact that investment requirements in absolute terms per household in the most expensive Cluster 16 are roughly 10 times greater than in the most cost-effective Cluster 1. Cluster 10, the last cluster where it is still profitable to provide a service, still requires approximately 2.5 times the investment per connection than for the most densely populated Cluster 1. A fibre optic network covering 60% of the populated area of Switzerland would require investment of the order of CHF 7.8 billion (single fibre model) or CHF 8.9 billion (multiple fibre model). If fibre optic coverage extended to 80% of the populated territory, the investment necessary would be CHF 12.6 billion (single fibre model) or CHF 14.2 billion (multiple fibre model).

9. As regards the extra investment costs involved in the multiple fibre approach, it is true to say that these depend on the access point selected at which the separate networks of the co-operation partners can be connected to the conjointly used part of the network. In the case of access in the local exchange, a larger part of the network will have to be expanded using four-fibre technology. As there are also supplementary costs for this network segment, the overall extra costs are higher than would be the case with access at the distribution point. In this respect it applies that, despite the higher additional costs for access at the local exchange, this is nonetheless economically more efficient overall in most scenarios, as it means that inefficient duplicate investment by network operators in the feeder segment can be avoided. This aspect is sometimes not taken into account in the Swiss

discussion. Furthermore, the additional investment costs of the multiple fibre model are particularly cluster-dependent. They are highest in the most densely populated clusters and lowest in the least populated parts of the country. For the first six clusters in which fibre optic expansion is profitable, the additional investment costs of the multiple fibre model are 8.5% for access at the distribution point and 17.5% at the local exchange.

10. Our results therefore permit a detailed evaluation of the wide range of conclusions on additional investment costs in the Swiss discussion. The extent of the additional investment costs quoted by Swisscom to date in various publications, of between 10% and 30%, can be estimated and allocated more accurately on the basis of our results. The value last quoted by Swisscom of 22% with access at the local exchange is very close to the value produced by our model. The extra costs of 30% to 50% occasionally stated by Sunrise are, from our point of view, to be regarded as exaggerated. However, the underlying extra costs of 10% in the study compiled for Swisscom by Polynomics do tally for access at the distribution point. The extra costs in access alternatives of primary relevance have consequently been markedly underestimated.

11. On the one hand, the multiple fibre model can be compared with an infrastructure competition model from a competition policy point of view, where two or more competitors simultaneously roll out an optical fibre network as a single fibre model, and on the other hand with a fibre optic unbundling approach, where several competitors access the fibre optic network (single fibre model) at the local exchange. In this respect, our model results are close to the following consideration hierarchy:

a) The replicability of a single fibre optical network is theoretically limited to the three most densely populated clusters we have examined. This means that the duplication of optical fibre connections is cost-effective, at least theoretically, for up to 16.4% of all connections.

b) Competition based on the multiple fibre model is possible for a significantly greater proportion of connections than pure infrastructure competition. According to our model results, the multiple fibre model enables competition for two operators up to the 9th cluster or for 54% of all connections. Four operators can theoretically exist alongside one another in the multiple fibre model for 36% of connections. However, this only applies if access to the multiple fibre model takes place in the local exchanges. If access takes place at the distribution point, the options for competition in the multiple fibre model are more limited. In this case, there are theoretically market opportunities for two suppliers up to the 7th cluster, i.e. for 42.1% of the population and for four suppliers up to the 3rd cluster, i.e. for 16.4% of the population. Allowance for uncertainty in making a decision on the market share distribution to be expected leads to a situation where the extent of competition expected for the multiple fibre model actually and realistically lies markedly below the theoretical possibilities mentioned.

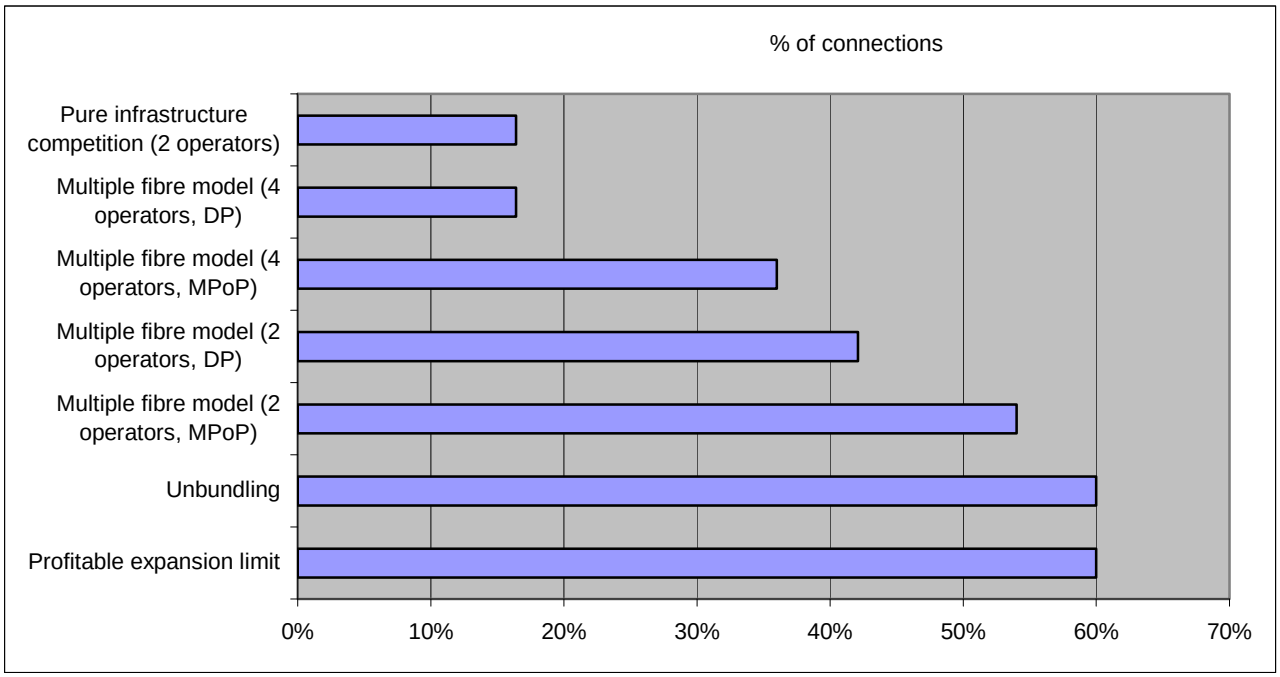
c.) Competition on the basis of optical fibre unbundling, on the other hand, is possible everywhere that a fibre optic network can be cost-effectively expanded. According to our model results, this is the case for approximately 60% of all connections.

d) Needless to say, competition on the basis of unbundling is possible everywhere that pure infrastructure competition and competition on the basis of the multiple fibre model are possible. It is also true to say that competition on a multiple fibre model basis is possible everywhere that pure infrastructure competition is also possible.

e) The degrees of technological freedom to provide a service with access to an optical fibre connection via a fibre optic unbundling approach are (virtually) the same than the use of a fibre optic connection in the multiple fibre model opens up. In both cases, the particular connection user has physical access to the optical fibre and can specify and control his service provision himself without limitations using his own active network electronic equipment. The respective installer and operator of the passive fibre optic infrastructure do not impose any limitations.
The following figure shows the scope of competition offered by the three basic models. From a competitor's point of view it is clear that the choice of one of these basic models is determined to a great extent by expectations of the achievable market share. Even if these expectations prove not to be identical to his current market share, then in realistic terms this expectation is significantly informed by his current market share. As current shares of the Swiss market are distributed (very)

asymmetrically, the "scope" of competition models derived from our model represent theoretical upper limits, as they are based implicitly on a distribution of market shares which is symmetric.

Figure 0-1: Scope of the three basic models of network competition



DP: Distribution Point
MPoP: Main Point of Presence

Source: WIK-Consult

12. If competitors have a choice between unbundled access and co-operation within the framework of a multiple fibre model, they can and will decide on the model that is more efficient from a competitive point of view. This choice will not lead to the same result in every fibre optic expansion region. A multiple fibre model will be preferred in regions in which competitors already have at their disposal an existing fibre optic infrastructure in the feeder area of the network or where they can lay optical fibres at a reasonable cost. Furthermore, the multiple fibre model will find support in scenarios in which either the initial market share of a competitor is high or the outlook is positive because of special circumstances. In this respect the probability of the market players co-operating in the multiple fibre model will then be quite high, if the critical market shares necessary for the profitability of the expansion of fibre optic networks are low.

13. Comparison with results for other countries shows that Switzerland stands out, because unlike the situation in many other countries, a profitable fibre optic expansion is possible for a substantially larger proportion of the population than elsewhere. The greater coverage possibilities in Switzerland with a state-of-the-art fibre optic network do not mean that the laying of fibre optic networks in Switzerland is cheaper to achieve than in other European countries or that the population of Switzerland lives in more densely populated areas. This result is clearly attributable to the fact that a higher price level exists in Switzerland for telecommunications services than in other European countries and a higher proportion of triple play customers can be expected. In the case of the services we individually modelled, this leads to approximately 50% higher revenue than in a large number of other countries.

14. Higher end customer prices and higher margins for the network operators can only be accepted from the point of view of the national economy if increased profitability leads to a more rapid transition to a state-of-the-art telecommunications network infrastructure. Otherwise, an inflated price level for telecommunications services would lead to welfare losses from the point of view of the national economy. If the higher profits in the case of telecommunications services were used today to ensure that Switzerland would in future have the most powerful telecoms infrastructure more quickly than other countries in Europe, this could be advantageous for the whole of the Swiss economy from a dynamic viewpoint. However, it remains the duty of the state to ensure this by appropriate means and

not to leave it exclusively to the decisions of the market players, given their aim is to optimise their individual profits.

15. It also applies for Switzerland that economic expansion options only exist in the more densely populated parts of the country, primarily concentrated in the large towns and cities. Examination of the spatial clusters in relation to profitable fibre optic expansion indicates that the coverage area that can be shown to be profitable is small. Only 60% of Swiss people or Swiss companies that are located in 8.3% of the most densely populated areas can be profitably connected to the fibre optic network.

16. The market itself will not lead to universal provision of optical fibre connections in Switzerland. A universal service obligation based on a nationwide provision approach would result in significant net costs. The provision of approx. 250,000 households and companies in the most cost-effective regions would require the same level of investment as for establishing a nationwide mobile telephone network in Switzerland.

17. Our results also indicate that there can be a series of measures with which the coverage of fibre optic expansion can be extended without having to resort to the universal service mechanism of the Telecommunications act. It is questionable whether total fibre-optic coverage in Switzerland would withstand a costs-to-benefits analysis from the point of view of the national economy. The necessary investment required that we identified would appear to be excessive. However, this must remain conjecture at this point, as we have not investigated the benefits of nationwide provision with optical fibre connections in Switzerland within this study over and above the willingness of users to pay assumed by us.

18. The examples of referenda in Zurich and St. Gallen and the general commitment of the municipal electricity companies indicate that rapid provision with optical fibre connections is rated as very important by Swiss citizens and Swiss politics. The commitment of companies in this market, who are not exclusively obligated to a company goal of maximum profits, gives more leeway for nationwide provision. Using the mechanism of internal subsidies from profitable districts, expansion could also be extended to include unprofitable districts without company losses having to ensue as a result. From the point of view of the cost function of fibre optic networks, the mechanism of internal subsidies can substantially drive forward nationwide coverage in Switzerland. Our study has shown in detail the extent of the influence of company objectives on the degree of expansion that is achievable in an area. There is a coverage difference of 20% of the population.

19. Our results also confirm for Switzerland that the competition model of pure infrastructure competition of various fibre optic networks constructed in parallel represents an economic illusion. Only in very few urban districts would the duplication of the fibre optic infrastructure also be cost-effective or even sustainable in Switzerland. However, given the costing structure of fibre optic networks, this approach does not work as a general competition model from an economic policy viewpoint. This does not preclude a cable network competing with a fibre optic network. Cable networks have a different costing structure to fibre optic networks and, in relevant parts of the market, can provide effective competition to a fibre optic network. Given the focus on fibre optic networks of this study, the question of cable networks competing against fibre optic networks was not investigated in detail.

20. Otherwise in Switzerland to date it is primarily or perhaps even exclusively the competition model for infrastructure competition based on multiple fibre expansion that was developed and propagated by Swisscom which has been discussed. Our results indicate that this competition model increases the replicability of networks in comparison with pure infrastructure competition and it therefore has importance as a competition model. However, our model results also show that the competitive extent of the model is limited. It can be extended, if there is a move from a symmetrical distribution of costs in the direction of market share-orientated cost distribution. Also, the scope becomes greater if competitors' access does not take place in the distribution point, but at local exchanges. Even taking these aspects into consideration, other market participants can only conclude economically viable co-operation agreements in a limited number of constellations. In particular if, in a co-operation model of this type, bearing the costs is not closely correlated with the ex-post realised market shares, in many relevant scenarios it leads to a situation where the weaker market participants are effectively subsidising the stronger ones. As long as this happens, there will be no stable, settled market model in this context.

21. To date in Switzerland, too little attention has been paid to the unbundling competition model. We have shown that, via the unbundling of fibre optic connections, competition between a number of suppliers is possible everywhere that a fibre optic network can be profitably expanded. In this respect, this model demonstrates the largest (conceivable) scope of an infrastructure competition model. If Switzerland seeks to optimise the opportunities offered by competition in fibre optic networks, it should introduce unbundling as an option in its politico-economic designs. There may be market players in Switzerland for whom involvement in a co-operation model on the basis of a multiple fibre approach would appear profitable, by virtue of the fact that they already have their own infrastructure. However, this does not apply to all relevant market participants. Switzerland will only be able to exploit the potential offered by competition if Swiss suppliers have the option of choosing the competition models that are suitable for them as a business model.

22. The study concludes with 30 recommendations, allowing telecommunications policy to support the fibre optic expansion in Switzerland.