



**Escola Politècnica Superior
de Castelldefels**

UNIVERSITAT POLITÈCNICA DE CATALUNYA

MASTER THESIS

TITLE: Neutral dark fibre operator in the city of Barcelona: Technical solution and business model

MASTER DEGREE: Master in Science in Telecommunication Engineering & Management

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DATE: March 4th, 2011

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Summary

This thesis aims to study the **technical and economic feasibility of developing an operator of dark fibre in the city of Barcelona** to provide rental fibre services and room to telecom operators to offer high-speed connectivity services to optimally rolling out a civil infrastructure with the aim to transform operators high investment costs in operating expenses.

Currently, the 22@Barcelona municipal company operates as a neutral dark fibre operator on a network that is rolled out in the area of Poble Nou. This municipal network is used by several telecom operators to offer their services to businesses. Taking into account the success of this model, it is of interest to study the fit of a network of its kind in the rest of the city, so that citizens, businesses and entities can benefit from the advantages of such a network model.

Taking into account the above, this thesis aims to build a technical solution and an economic model for the **deployment of a fibre optic network in the city of Barcelona**, managed as neutral dark fibre network. This project will seek to discover the main issues to be faced by the hypothetical neutral operator in developing a network of these characteristics.

The business plan of this project consists of the following points:

- Make a **market study** to determine the density of demand in the city (residential and business sector).
- Based on this demand, **study the civil infrastructure and technological solution** needed to cover it, exploring all the possibilities that the city can offer (service galleries, sewers, Underground existing pipes, etc ...).
- **Dimension the optical fibre network** needed, but also taking into account that this network can be used for self-provision services of the city (traffic lights, traffic cameras, street lights, wifi, etc.).
- Develop a **business model**, which consists in developing a business plan and study the economic feasibility of the project. This business model has been made taking into account the existing regulatory framework for telecom networks operation by Public Administrations.

Títol: Operador neutre de fibra fosca a la ciutat de Barcelona: Solució tècnica i model de negoci

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Data: 4 de Març de 2011

Resum

Aquest treball té per objectiu estudiar la **viabilitat tècnica i econòmica de desplegar un operador de fibra fosca a la ciutat de Barcelona** per tal d'oferir serveis de lloguer de fibra i espais a operadors de telecomunicació per oferir serveis de connectivitat a alta velocitat de manera òptima, desplegant una única infraestructura civil i transformant per aquests, altes despeses d'inversió en despeses d'operació.

Actualment, l'empresa municipal 22@Barcelona gestiona com a operador neutre de fibra fosca la xarxa que hi ha desplegada a la zona del Poblenou. Aquesta xarxa municipal, és utilitzada per diferents operadors de telecomunicació per oferir els seus serveis a les empreses. Tenint en compte l'èxit que ha tingut aquest model, és d'interès estudiar l'encaix d'una xarxa d'aquestes característiques a la resta de la ciutat perquè els ciutadans, empreses i entitats puguin beneficiar-se de les avantatges d'una xarxa d'aquestes característiques.

Tenint en compte al descrit anteriorment, en aquest projecte es pretén construir una solució tècnica i un model econòmic per al **desplegament d'una xarxa de fibra òptica a la ciutat de Barcelona**, gestionada com a xarxa neutre de fibra fosca. Aquest projecte tractarà de descobrir les principals qüestions a les que s'enfrontarà l'hipotètic operador neutre a l'hora de desenvolupar una xarxa d'aquestes característiques.

El pla de activitats d'aquest projecte consistirà en els següents punts:

- Es farà un **estudi de mercat** per determinar la densitat de la demanda que hi ha la ciutat (sector residencial i sector empreses).
- En funció d'aquesta demanda s'**estudiarà la infraestructura civil i la solució tecnològica** necessària per poder cobrir-la. En aquest apartat s'hauran estudiar totes les possibilitats que pot oferir la ciutat (Galeries de Serveis, Clavegueram, Metro, Canalitzacions Existents, etc...)
- Es **dimensionarà la xarxa de fibra òptica** necessària, però també tenint en compte que aquesta xarxa pot ser utilitzada per serveis d'autoprestació de l'Ajuntament (semàfors, càmeres de trànsit, enllumenat, xarxa wifi, etc.).
- Es desenvoluparà un **model de negoci**, que consistirà en realitzar un pla de negoci i estudiar la viabilitat econòmica del projecte. Aquest model de negoci s'haurà de realitzar tenint en compte les premisses de l'actual marc regulatori pel que fa a l'explotació de xarxes i prestació de comunicacions electròniques per les Administracions Públiques.

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INTRODUCTION

The main objective of this project is to build a technical solution and an economic model for the deployment of a fibre optic network in the city of Barcelona, managed as neutral dark fibre network to offer wholesale services to operators of high-speed services. The expectation is that it could be a simple model to explain the decisions concerning investments to be taken by municipalities or even new operators that are interested in building a network with these specifications. The model is designed taking into consideration the Eixample area of Barcelona, but it can be extrapolated to other areas with similar population density such as the rest of the metropolitan area of Barcelona.

This thesis is organized with the following chapters:

In the first chapter, the background and current status of municipal infrastructure in the city is analysed to see if the initiative is justified. Also the regulatory framework has been included required by the Comisión del Mercado de las Telecomunicaciones (CMT) for the exploitation of telecommunication networks by public administrations.

In the second chapter, the Next Generation Access Networks topologies are described to know the needs of the service operators in a neutral network. Also, the demand density from both the residential and business sector have been studied. Once this demand density is known, the dimensioning of the necessary fibre optic network and also the dimensioning of the civil infrastructure have been performed.

In the third chapter, the business model, analyzes the services that could be offer and the potential customers that could use the network. Afterwards, the business plan and the viability of the project in terms of results are presented and studied.

In the annexes, all the examples and data that can help understand the details of the model have been included.

CHAPTER 1. OBJECTIVES AND SCOPE

1.1. Background

Connectivity needs of citizens in Catalonia are increasingly high, and to cover these, a better quality of services and faster connections is necessary, i.e. a greater capacity for telecommunications networks.

Telecommunication operators give high speed to whom can pay a high cost for these connections, which are mostly big and medium enterprises. Small enterprises and residential users cannot enjoy these infrastructures and high speeds, because they cannot afford the costs or because optical fibre is not available, so they are still using the old copper wire.

Barcelona City Council solves their telecommunication needs on a self-service provision basis, by implementing new technologies and infrastructure in the city. And in a part of the city, used mainly for business use, it operates as an operator of dark fibre.

The city of Barcelona has many infrastructures that can be made available to the city itself and to telecom operators. That would represent the creation of benefits for citizens and operators, and solving the deficient network infrastructure present today.

Thus, taking into account that operators are not rolling out high speed infrastructures due to the large investment cost, and that the City Council of Barcelona has many ducts and lines of self-provision services, it makes sense to complete the existing network and thus offer excess capacity, so service operators can rent this infrastructure, and provide advanced services that allow the economic and social development that Barcelona requires.

1.2. Current situation

In the city of Barcelona there are many infrastructures that can potentially be used to provide telecommunications services. This section refers to those infrastructures where the City Council is owner or has some sort of right on its management.

Potential infrastructures are:

Table 1. List of existing infrastructure in Barcelona

Public Entity	Type of Infrastructure
22@Barcelona	Ducts infrastructure, fibre optics and rights of way.
IMI	Fibre optic infrastructure of Institut Municipal d'informàtica.
CLABSA	Right of way, ducts infrastructure and optical fibre to the sewer.
TMB	Right of way and ducts infrastructure to the Metro.
PÒRTIC BCN	Ducts infrastructure to the Barcelona port.
City Council	Ducts infrastructure from construction of new streets, other street actions, agreements with operators, etc.
City Council – Mobility	The network traffic light and mobility infrastructure.
City Council – Street Lighting	Street Light infrastructure.

Today some of these infrastructures are already used to provide services to the city itself (self-provision services to the City Council) or to telecom operators (service provider market). The relation of infrastructures is as follows:

Table 2. Services offered by the existing infrastructure in Barcelona

	Self-provision		Service Provider Market	
	DUCTS and/or RIGHT OF WAY	DARK FIBRE	DUCTS and/or RIGHT OF WAY	DARK FIBRE
22@Barcelona	✓	✓	✓	✓
IMI	✓	✓		
CLABSA	✓	✓	✓	
TMB	✓	✓	✓	
PÒRTIC BCN	✓	✓		
City Council	✓	✓		
City Council – Mobility	✓			
City Council – Street Lighting	✓			

The provision of services to telecommunications operators requires the institutions to be registered as operators of electronic communications.

The entities mentioned above, that have been found in the register of electronic communications operators of the CMT are:

Table 3. Barcelona entities registered as electronic communications operators

	Entities in the registration of operators of CMT				
	DUCTS	DARK FIBRE	VOICE	DATA	INTERNET
22@Barcelona		✓		✓	
IMI				✓	✓
PÒRTIC BCN				✓	

Clavegueram de Barcelona, S.A. (Clabsa) and Transports Metropolitans de Barcelona (TMB) provide to operators only rights of way, because operators install their own infrastructure. This service does not require registration as an electronic communications operator.

1.2.1. Current situation of infrastructure in Barcelona

In this section, existing infrastructure of the city is analyzed the proper for telecommunications services and other infrastructures capable to be used for the telecommunications market. Although those are commonly used by the services not related to telecommunications, they can complement this offer. For example, the mobility infrastructure and street lighting infrastructure have as a objective to ensure the availability of these two municipal services. The same happens in the construction of the Barcelona subway tunnels or in the sewers. But at the same time, these infrastructures can be useful for telecommunications services, although their nature may hinder its use.

The existing telecommunication infrastructures of the city are diverse. Municipal ducts are distributed unevenly in some neighbourhoods. Some other neighbourhoods or districts only have presence of specific backbone infrastructure on the main axes of communication like the ring galleries and major roads (see Figure 1).

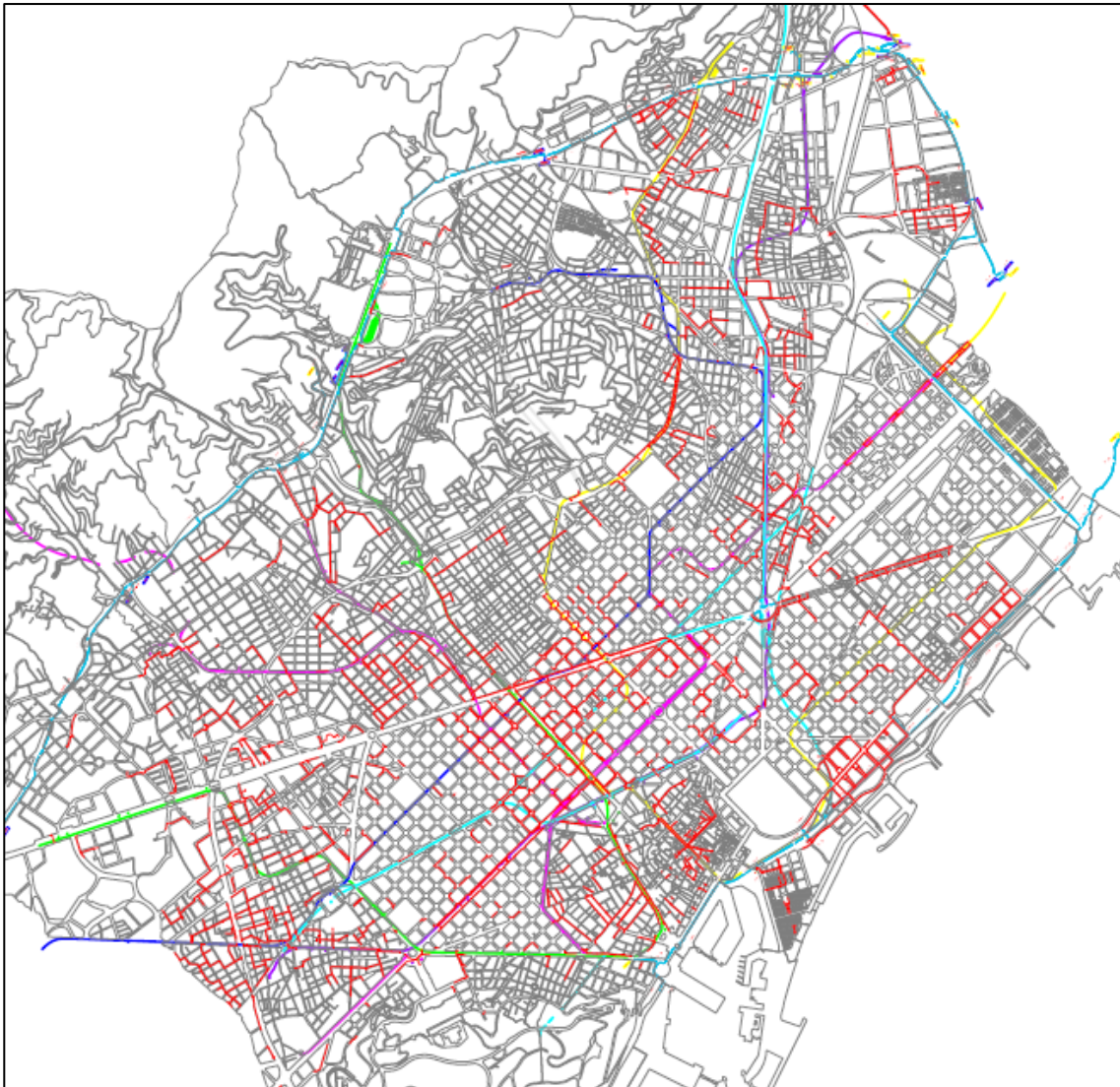


Fig. 1 Existing municipal telecommunications ducts and services galleries

Moreover, as already mentioned, the City Council of Barcelona has its own optical fibre network to provide their own transport services. This network extends throughout the city and could be considered as an important value to the hypothetical neutral operator. The following figure 2 shows the municipal fibre.

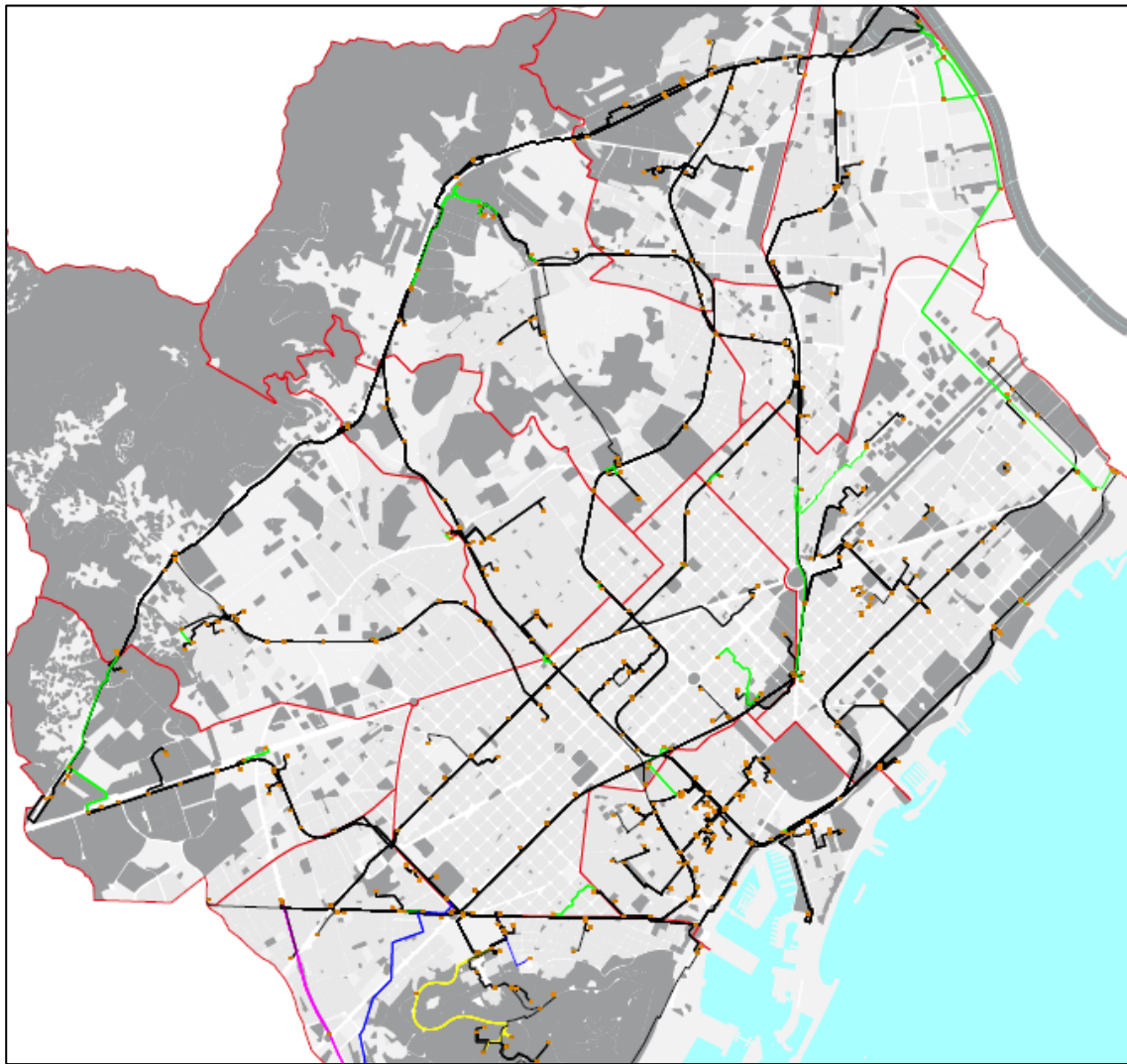


Fig. 2 Existing municipal fibre optic network

Infrastructures from entities such as TMB are included in the infrastructure used by the City Council. However, there are other infrastructures such as sewer and waste vacuum systems that are present in the city, and that can be taken into account for capillarity that they can offer.

In the case of the sewer pipes, these are exploited by Clabsa municipal company (that has also private shareholders), which already markets its infrastructure to the telecommunication operators in the form of rental of rights of way. The rent prices of this company are out on the market today, because they are very high when compared to the prices set by the CMT for the rent of the incumbent operator's infrastructure.

The following figure 3 shows the infrastructure of available sewer collectors in the city for the use of telecommunication fibre.

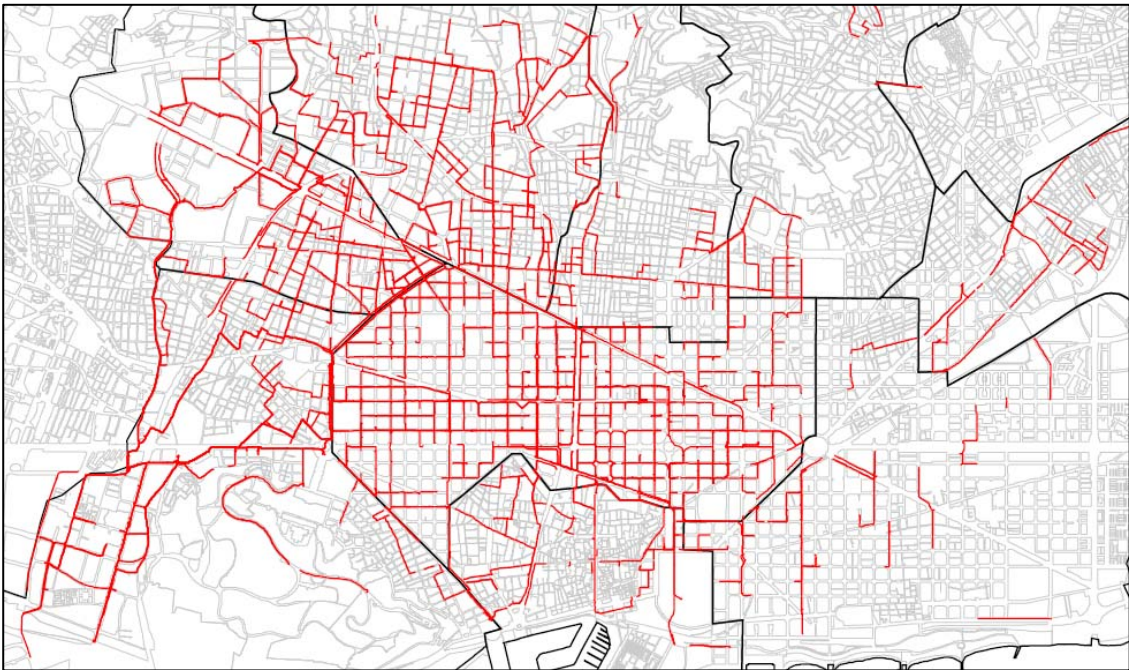


Fig. 3 Sewerage available to roll out fibre optic

Another municipal infrastructure that could be of great value to the neutral operator is the waste vacuum systems infrastructure. This network consists of a 500 mm pipe that evacuates the garbage and two 125mm-diameter ducts which are used for system communication. These two tubes could be used by our telecom operator. It is a network that is not too extended across the city, but in areas where it is installed it could solve the problem to connect the buildings. The following figure 4 shows the network of waste vacuum systems in the Barcelona Olympic Village area.

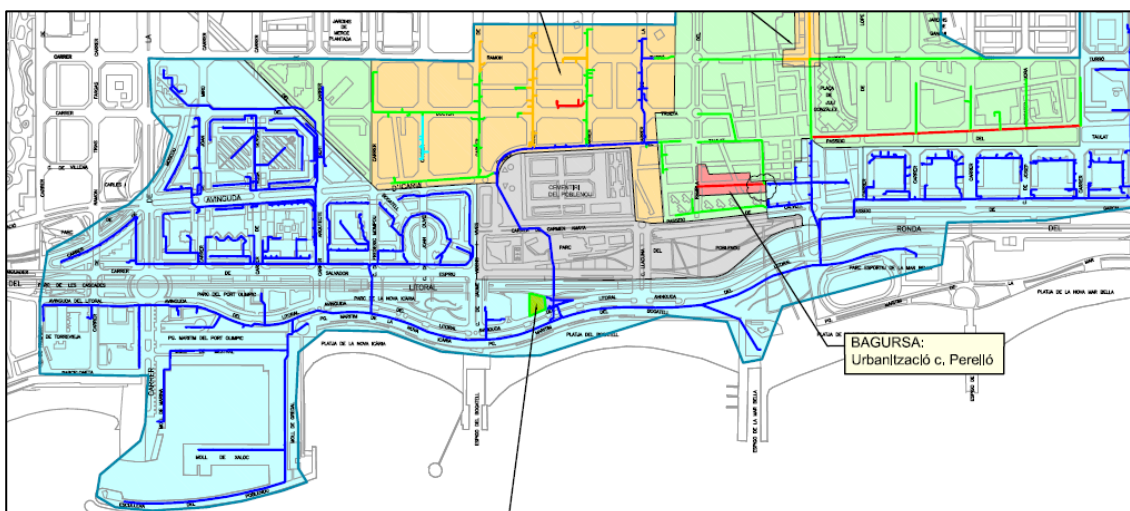


Fig. 4 Stationary vacuum Network for waste in the Olympic Village

Referring to the traffic lights and street lighting network, the network exists almost everywhere in the area of the municipality. These could provide a wider field of municipal infrastructure ducts, although currently the infrastructures are not available for telecommunications services.

This dispersion of infrastructure, which has been done independently without having a unified vision, may hinder the use of these for telecommunications services.

However, these difficulties are not in the whole city, there are areas in which the global planning of infrastructures is being implemented it, but only in specific urban areas, such as 22@Barcelona.

The following figure 5 shows the area of 22@Barcelona, which has a strong presence of ducts and fibre optic.

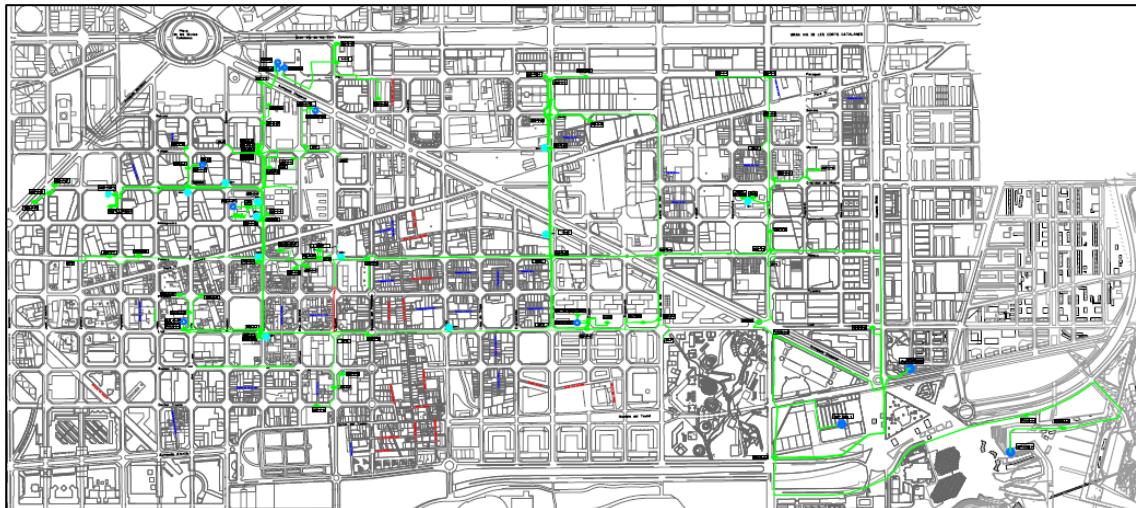


Fig. 5 Optical fibre current network of 22@Barcelona

Other areas that are under transformation are the future area of Sagrera or the future neighbourhood of La Marina, where there is a global overview of infrastructures that will be built to solve connectivity issues, like in the 22@ neighbourhood.

To conclude this section, the City Council has inventoried its infrastructures, which are 270 km of ducts, 200 km of optical fibre and 600 km in which rights of way can be used through sewers and subway tunnels. The rest of the infrastructure in the city, as it has been made by different entities in the city, without incorporating a global vision, is not available in electronic format nor centralized.

Therefore, when performing the business plan of this project, we must work with an estimated percentage of infrastructures that would be available to use.

1.2.2. Management of the telecommunication infrastructures in the city

This section gives an overview that the neutral operator would be found if could start to use the existing infrastructure of the city. Probably it will happen similar in other municipalities.

As seen in the previous section, the multitude of infrastructures in the city of Barcelona, and their purpose, has meant that each of the infrastructures has been managed vertically. So telecommunication infrastructures are integrated with other infrastructure (sewer, traffic network, etc.). These are managed by each of the entities with different criteria and models.

Therefore the neutral operator should consider the following points:

- To perform any action in the city, it needs to establish relationships with multiple spokespersons.
- Most infrastructures of the city are not documented, and therefore the existence is unknown of to whom must be users.
- There is not an infrastructure plan in the municipality; are acted only under the order requests.

The following figure shows the flow of operations, where priorities are displayed in the utilization of existing infrastructure. As a final option the infrastructure will be built.

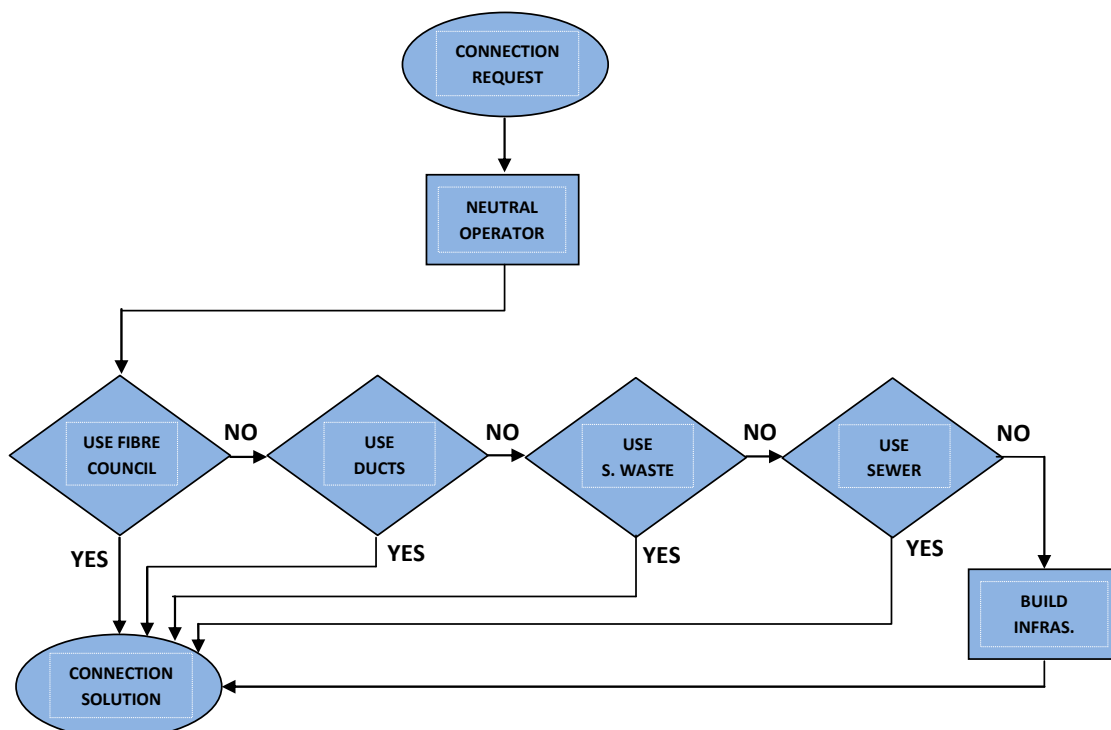


Fig. 6 Flow of operations

A connection between two points of the city may involve the use of multiple infrastructures, including; sewer, mobility ducts, street lighting ducts, etc.

1.3. Justification of the initiative

1.3.1. Overview

The Digital Agenda is Europe's strategy for promoting digital economy by 2020. It outlines policies and actions to maximise the benefit of the Digital Revolution for all.

Regarding Internet, the Digital Agenda says that 30% of Europeans have never used the Internet, but the services and the number of companies in the network are becoming more numerous. Only 1% of Europeans using the Internet have a fast connection through optical fibre. If we compare it with Japan (12%) or South Korea (15%), Europe must move forward a lot and very quickly if wants to stay in the race.

On the other hand, the Commissioner in charge of the Digital Agenda, Neelie Kroes, said: "is a priority to ensure that information technology improves our daily lives, citizens and businesses" and adds: "every European citizen should benefit of the digital economy so that IT and high-speed Internet could be as revolutionary in our lives as was a century the development of electricity networks or transportation".

In the latest study by the OECD (Organisation for Economic Co-operation and Development), we can observe the evolution in access capabilities of networks based on fibre optics. In the case of Spain, there is not a general offer of fibre optic service, and used the infrastructure of copper pairs is still, mainly for the provision of xDSL services.

Fastest advertised broadband speeds, using fibre, Kbit/s, Oct 2009

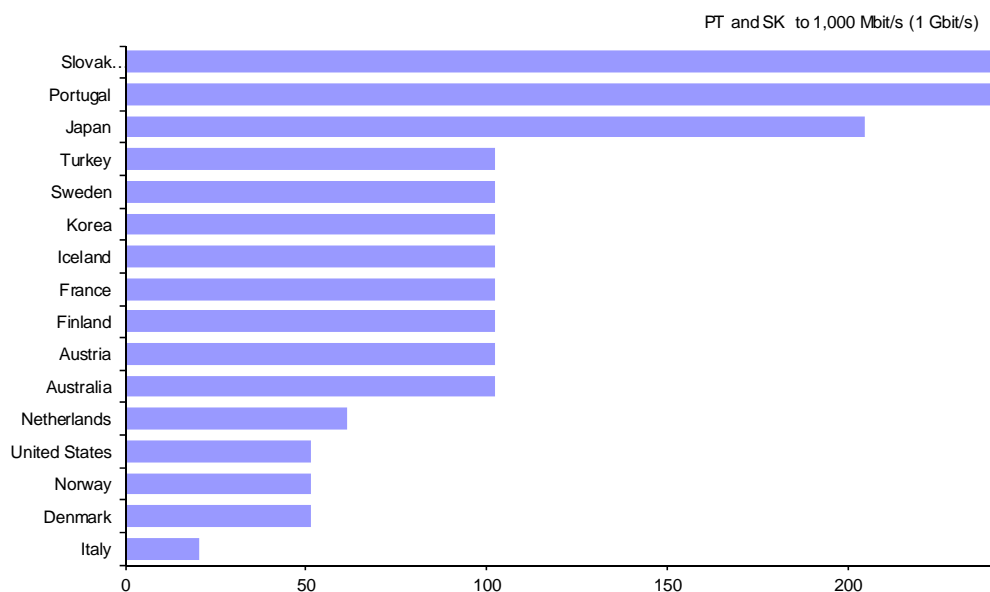


Fig. 7 Offers broadband services based on fibre. OECD in October 2009

Note that any technological evolution, both mobile and fixed network infrastructure requires the availability of optical fibres. . Internationally, the current positioning of Barcelona in infrastructure and service offerings, doesn't leave the city in a good situation.

1.3.2. Connectivity needs of the city

The connectivity needs of the city are increasing, as is the volume of information that the city should manage.

The city of Barcelona is facing a situation conditioned by a greater number of smart devices in the street (Smart City). A significant part of these devices are linked to the intelligent city and require connectivity.

These needs in short, medium and long-term, will increase the communications requirements of the city. If this is not faced by the public sector, the needs should be covered with the connectivity contracted in the private sector with increased public expenditure.

1.3.3. Needs of telecommunication operators

The operators need to evolve their fixed and mobile networks to respond the evolution of services for citizens and businesses demand. Operators face the following scenario:

- Time reduction of the time of return on investment due to the continuous technological innovation.
- New infrastructure requirements (fibre and duct), deployment of next generation networks (FTTH Networks).
- Better communication capacity of the mobile stations for data services (need for fibre optic connection).
- Budgetary restrictions that limit investment in civil works and infrastructure.

Telecom operators invest in areas that are economically more profitable. Obviously, the city of Barcelona is a concentrated area of investments. However, the required speed of deployment is not always homogenous and neither possible for the entire investment.

The availability of telecommunications infrastructure facilitates the spread and evolution of telecommunications services in the city.

1.3.4. Immediate opportunities

This past August the European Commission adopted, in accordance with state aid rules of the EU, the development of the Xarxa Oberta project of the Generalitat de Catalunya. Xarxa Oberta consists of a state-owned deployment of a next generation network to connect the regional government buildings. This network will enable the government, including institutions located in outlying areas, responding to increased expectations of citizens regarding the provision of advanced electronic services in health, education and administration.

The European Commission in its report (included in Annex III), says to cover the current and future private demand of very high broadband capacity and stimulate the competitive provision of broadband services, the private telecommunication operators may obtain fair and non discriminatory access to the available capacity of this public infrastructure throughout the region, with the exclusion of the four provincial capitals (Barcelona, Tarragona, Lleida and Girona).

The exclusion of Barcelona by the European Commission in the Xarxa Oberta project is a good reason to plan the neutral dark fibre project in the capital of Catalonia, acting with the principles of a private investor and without public aid.

Xarxa Oberta aims to connect 140 public buildings in the city of Barcelona. The City Council in this area may have the infrastructure that the Xarxa Oberta operator may require on a short-term.

1.4. The Dark Fibre as solution to the needs

Optical fibre is a medium that has a very high transmission capacity and which is used as a transmission technology in electronic communications networks. When speaking about dark fibre, it means the physical cables are not connected to electronic equipment. Dark fibre is used as a means of entry for basically all electronic communications and may be used by different segments or an entire unit interconnected network. For example, the dark fibre can be used to connect different end users of broadband services, equipment located in local stations, mobile phone base stations, traffic light controllers and numerous other purposes.

Dark fibre is the main demand for operators at this moment, in order to improve the service demand for end users. Taking into account the increasing demand for services, that require more capacity and the development of future IP-based networks and NGN, the demand for dark fibre service has increased and in the future will increase.

The fact that dark fibre is an excellent gateway to many retail services, means that conditions of competition in this market are fundamental. Insufficient competition in the market for dark fibre will have a negative impact on

consumers, particularly in services. Consequently, dark fibre is extremely important so that market can function properly.

Telecom operators with fibre have a greater potential for competition, because they can act on the fibre at different levels. Thanks to the high capacity transmission of the fibre, these operators have different alternatives using fibre as the wavelength services, rented lines, radio links and end user service.

The operators that cannot roll out their own fibre because they can not carry the considerable investment required. They are in a clear competitive disadvantage. Therefore, the absence of dark fibre means that there are barriers to entry for many operators, which ends up affecting end users.

Dark fibre is the first layer of telecommunications that generates no competitive differentiation, because it is technologically simpler and less risky. Instead, the following layers of a telecommunications network, equipment and software, are linked directly to the competition of operators, because electronic equipment are linked to the management and maintenance of the operator's network and indirectly to the final service. Therefore, if operators can choose their own electronics, it means that competition is promoted. However, if you force all operators to use the same electronics, this could reduce the competition between operators.

Considering that fibre is the most expensive layer of telecommunications and electronics is affordable for any operator, only rolling out dark fibre is enough to improve the telecom market competition.

1.5. Regulatory framework

This section aims to analyze the Spanish and EU regulatory framework, to know the rules that would face the neutral operator.

Basically, these rules are defined in the Circular 1/2010, adopted by the CMT on June 15th, 2010, which sets the conditions for the exploitation of networks and the provision of electronic communications services by public administrations and the entities in which public authorities may exercise, directly or indirectly, a dominant influence or effective control by reason of ownership.

Therefore, this circular directly affects the purpose of this project and particularly the concept of private investor that must be taken into account in the business plan, then describes the part of the circular referred to the private investor (the Circular is included at Annex II):

A Public Administration that wants to exploit public networks or electronic communications services available to the public, must act in accordance with the principle investor in a market economy, when it acts in accordance with the following criteria:

- *To be the activity aimed at obtaining positive returns through the income, consistent with the commonly available on the market, all costs of provision, recurring and non-recurring, more an adequate return on capital, taking into account the assumed risk of the investment. According this aspect must be a solid business plan, coherent and plausible hypothesis.*
- *Generate the project a positive cash flow during the relevant period. To the extent that horizon of generation of a positive cash flow in net terms is delayed, that fact must be reflected in the project risk and the required return.*

The CMT Circular also mentioned that when a Public Administration seeks the operation of networks or the provision of electronic communications services to third parties without being subject to private investor, they must notify the project to the European Commission unless there is no state aid or, in accordance with established by Regulation 1998/2006 of 15 December 2006 concerning the implementation of Articles 87 and 88 of the Treaty to of minimum aid, are exempt from being reported.

With regard to state aid there is a reference in Catalonia, as mentioned in section 1.3.4 of this thesis. European Commission in resolution N407/2009 approved in accordance with the state aid rules of the EU, the development of Xarxa Oberta, with the exception of Barcelona. Therefore, the EU made clear that the establishment of a neutral operator in the city of Barcelona can only be carried out with the principles of private investors and without state aid.

CHAPTER 2. TECHNICAL CRITERIA

In this chapter, the network dimensioning is done, both in optomechanical installation and in civil works, depending on the demand and taking into account the range of next generation access networks that the service operators can use. Therefore, this chapter is divided in four sections, NGAN, demand study, and the dimensioning of the optomechanical installation and civil works.

2.1. Next Generation Access Networks

Today, the increased capacity of computers, devices and network cards, among others, has led to an exponentially increased demand for Internet applications and multimedia services. New services emerge and are consolidated in the market. Services that require higher bandwidth than currently offered by copper networks, which are limited in their transport capability and act as a bottleneck. Solving this problem is the purpose of optical access networks, and the solution to implement these new types of networks pass through replacing copper by fibre.

This section wants to give the reader an overview of different NGN implementations that can be made with fibre. Taking into account that the network is dimensioned in this project, has to accommodate all topologies and NGN technologies for allowing operators to select any technologies that are detailed below.

2.1.1. FTTx

The optical access network concept is very broad and has several variables depending on how it reaches the user with the fibre. These new techniques are distinguished by their acronyms that describe the implementation selected. In the generic case, the Fibre to the "X" is the name that includes all the technologies used to deploy fibre to the last mile to the end users. This letter indicates the distance or the place where the fibre arrives. The current trend and most logical is the model that has an "H", which means fibre to the home (FTTH).

There are mainly four different FTTx approaches.

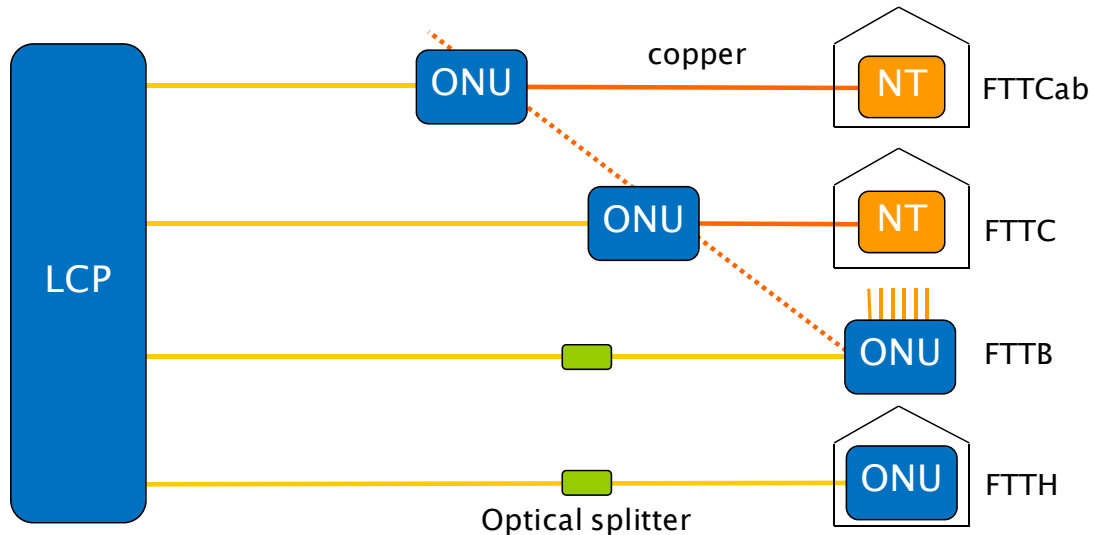


Fig. 8 FTTx approaches

- FTTCab (Fibre To The Cabinet):** This architecture runs an optical fibre from the LCP to the neighbourhood cabinet, where the signal is converted to feed the subscriber over a twisted copper pair. Typically, the neighbourhood cabinet is about 1 km from the subscriber's home or business. The cabinet distributes and aggregates traffic to the end users. From that point to the end subscriber, the twisted pair transmits data to the end subscriber. Data rates are mainly limited by the product bandwidth per distance of the copper cable. The numbers of users sharing the ONU are from 64-128.

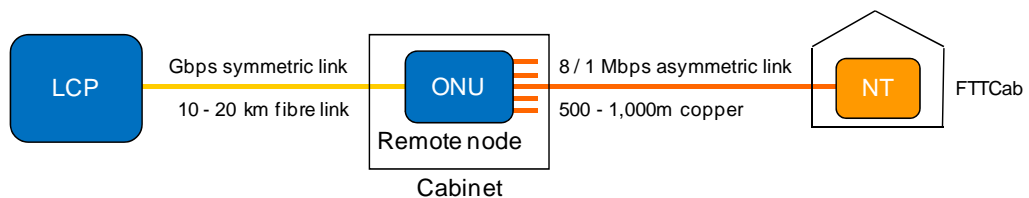


Fig. 9 FTTCab block diagram

- FTTC (Fibre To The Curb):** In this case the fibre comes from the LCP to curb-located cabinet, which is nearer (typically within 100 – 500 m) to the subscriber. It is then converted to twisted copper pair. The numbers of users who share the ONU are between 16-32.

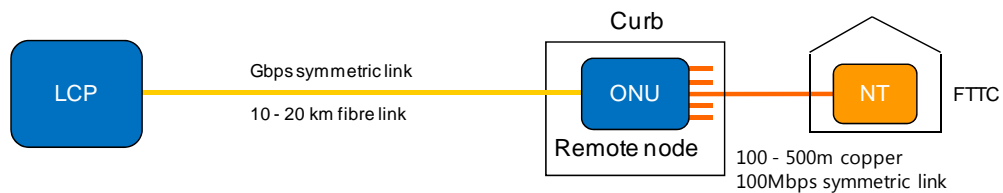


Fig. 10 FTTC block diagram

- FTTB (Fibre To The Building):** Also called Fibre To The Base. Here arrives the fibre to the same building, to an item in the basement or on the roof, and from there is distributed to homes with copper. There is a single ONU throughout the building, so that the remaining copper is less than 500m. The numbers of users sharing the ONU are from 8-16.

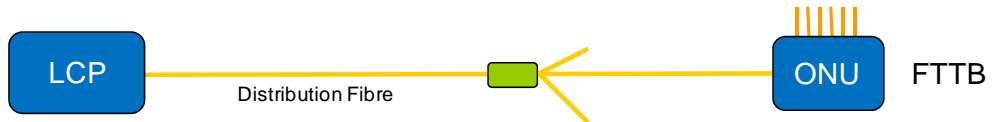


Fig. 11 FTTB block diagram

- FTTH (Fibre To The Home):** Also called Fibre To The User or Fibre To The Desk. In this case runs an optical fibre from a LCP to an optical splitter and on into the subscriber's home or building. This is the last stage of the evolution as optical fibre runs all the way between the LCP and the end subscribers. In this scenario, the network infrastructure has unlimited transmission capabilities, which are just limited by the technology used for the data transmission and the electronics used for its implementation.

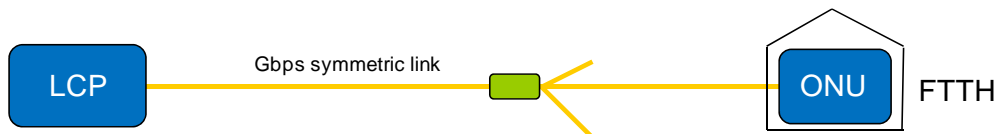


Fig. 12 FTTH block diagram

2.1.2. Topologies and models: P2P and P2MP

The quantity of fibre for each user is decided depending on the use of optoelectronics components in the network, and installation technique. Most point to point (P2P) systems are based on a fibre pair, one for the uplink, while the other for the downlink. Although today systems based on WDM techniques are available that multiplex the uplink and downlink on the same fibre at different wavelengths. Thus, the number of fibre is reduced to a single fibre per user.

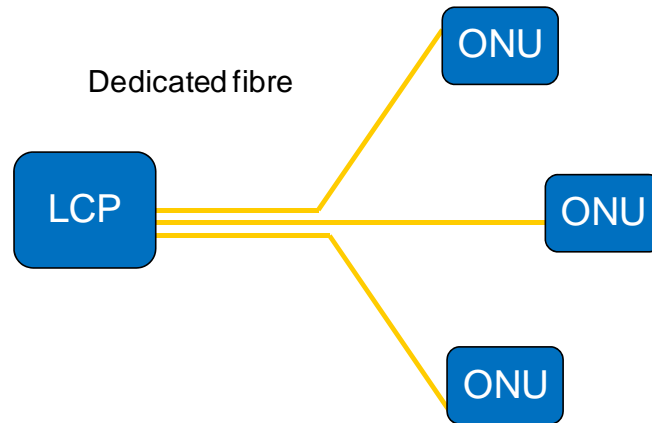


Fig. 13 P2P architecture

As already mentioned, the telecom operators will have to decide which topology and technology to use. Therefore, who uses PON should plan one or more splitters in cascade, depending on the topology of the network. The ITU-T G.983 recommends a ratio of up to 32, while the G.984 recommendation extends it to 64. Consequently, the degree of splitting is a decision of telecom operators. However, the most logical plan will be up to 2 stages in residential development concentration, i.e. P2MP. And special services, point to point (P2P) (without concentration stages). Therefore, telecom operators should assess the number of multiplexing stages, taking into account the previous conditions and their user's distribution (residential / business).

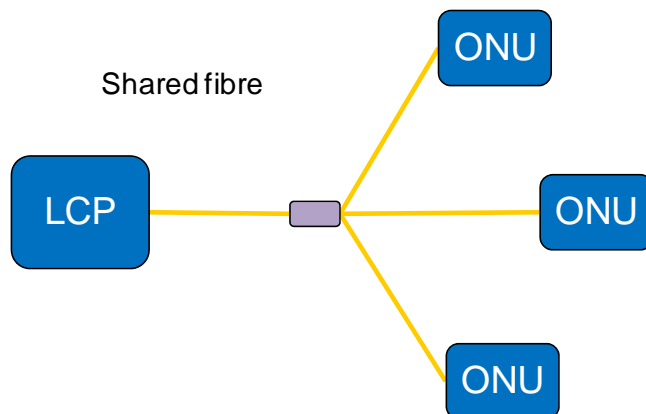


Fig. 14 P2MP architecture

2.1.3. Passive versus Active architecture

A Passive Optical Network (PON) consists of an optical line terminator (OLT) located at the Local Convergence Point (LCP) and a set of associated optical network terminals (ONT), also known as optical network units (ONU) to terminate the fibre. Remote nodes are passive, therefore do not need power, enabling easy maintenance and scalability of the network and don't require extensive network management and will be transparent from operator's point of view. But the cost of implementing a passive solution is user's management that will increase the difficulty.

For data reception the data will be only processed in ONUs that will have the corresponding direction of the header data. When transmitting, all ONUs must be coordinated to avoid collisions. By having a common communication channel, the operators should use encryption algorithms and media access.

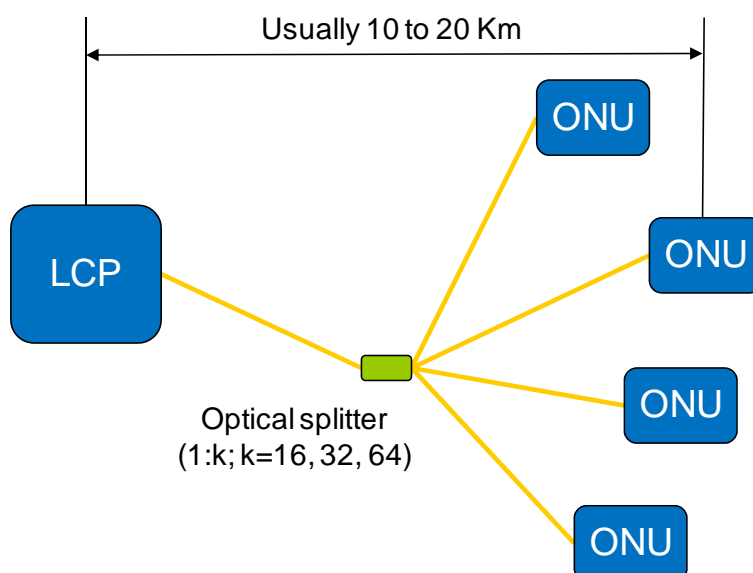


Fig. 15 PON architecture

One of the most recently used passive technologies is the GPON. Downstream traffic is shared by all users. Both the downstream and the upstream are transmitted in the same optical fibre. It uses WDM (Wavelength Division Multiplexing) multiplexing. The same information is received by all ONUs. The problem with this technology is that unbundling is not possible, because the downstream is the same 2.5 Gbps of traffic in all ONUs. Only a P2P technology will allow for full unbundling.

On the other hand active networks look very similar to PONs, however there are several important differences. The most relevant one is that instead of having passive splitters in the field, it uses electronics to provide fibre access aggregation. At the remote node, there is a dedicated connection between the LCP and each of the ONUs by means of an active electric switch. Choosing an

active solution, may be motivated by the selection of a mature solution that enables progressive aggregation, simplifying OAM (Operation Administration and Maintenance). But that means having a management system of active elements that can cause power failures. These solutions also increase the cost of implementation and the need an electrical connection.

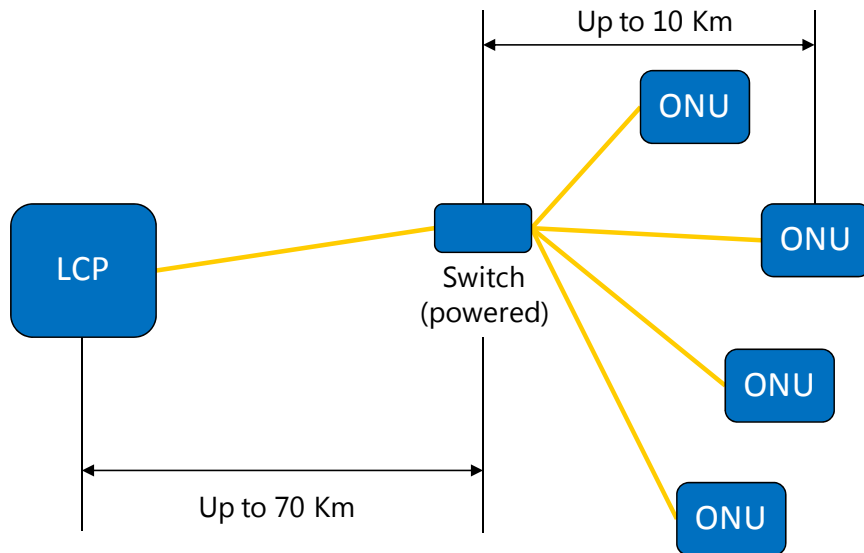


Fig. 16 Active architecture

Access networks should be simple and easy to operate and maintain. They should be inexpensive to be a cost effective solution for service operators and at the same time affordable for users. For these reasons passive architectures are preferred.

2.2. Demand density

The first step in dimensioning a network is to know which potential demand must be covered. In the telecommunications market there are two distinct markets, one is the residential market and the other is the business market. And in this case we have to take into account that the network will also provide self-provision services for its municipal network condition.

Analyzing the Barcelona town planning, it is observed that most is formed by a uniform grid of blocks. This uniformity is due to the urban expansion area project, designed by town planner Ildefons Cerdà. The biggest representation of this model is in the Eixample district. Therefore it is reasonable to analyze these district blocks, and take these data as representative of the city demand.

Analyzing data from the Statistics Department of Barcelona City Council (included in Annex IV), premises averages per block in the Eixample district are as follows:

Table 4. Average of premises per block in the Eixample district

Distribution of commercial units per block	
Homes per block	345
Business premises per block	30
Industrial premises per block	25
Total commercial units per block	400

2.3. Dark fibre network design and dimensioning

Once the demand is known, the next step is dimensioning the dark fibre network, taking into account the needs of telecom operators. This network must respond to the needs of large, medium and small telecom operators, so that they can choose the technology that suits them.

The network topology consists of three typical segments of a telecommunications network:

The Feeder network segment connects the Hub/Headend of the city, such as the Carrierhouse or Catnix, to the Convergence Points (LCP) rooms.

A second segment network called in this project Distribution connects the LCP rooms to Network Access Point (NAP) rooms. These last rooms are designed to make the function of Telecommunication Common Infrastructures (TCI) room corresponding to each building. According to data from the Statistical Department of the City Council (included in Annex IV) buildings constructed after 2001, which is the year it began to require TCI projects to the buildings, represent only 3.53% of total buildings in the city.

The third segment network called Drop connects the NAPs to Optical Network Terminal (ONT) which is the end-user's connection to the network.

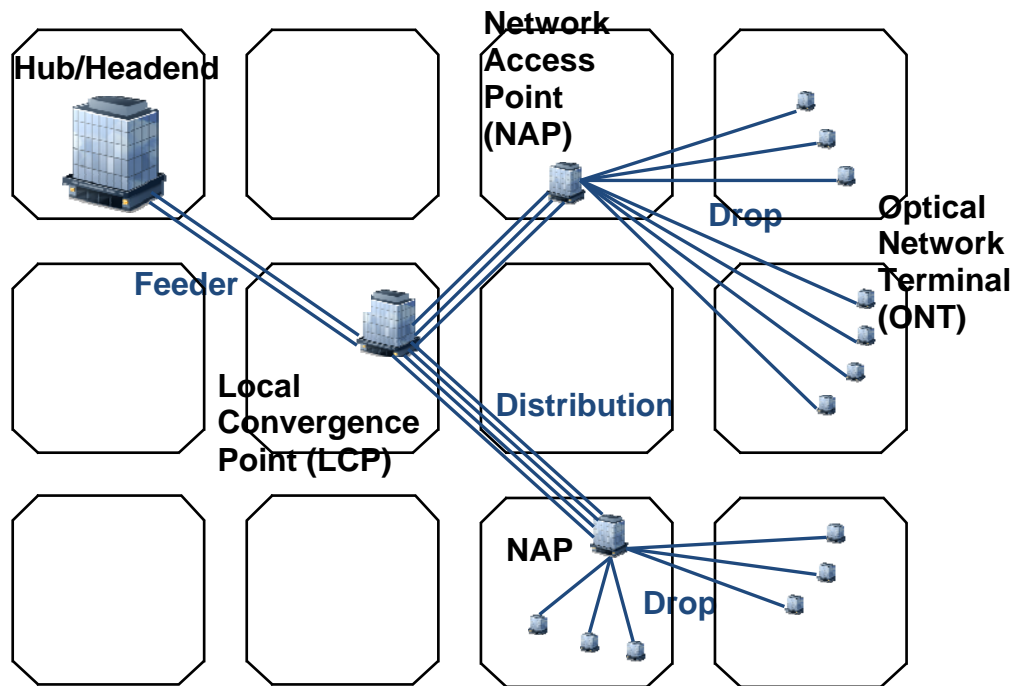


Fig. 17 General topology of the dark fibre network

2.3.1. Drop network segment dimensioning

The dimensioning of the Drop segment network, from NAP to the ONTs, is designed to reach 100% of demand. This does not mean, that the business plan is based on an estimation of a final subscriber penetration rate of 100%, as this would not be realistic. The advantage of this dimensioning to 100% is to avoid problems due to non-homogeneity in potential subscriber's distribution. Additionally, it should be noted that savings in cable would be obtained in dimensioning less than 100%, which would not be a large reduction in the cost of the project.

The topology of this segment is carried out in open ring form, which gives us the flexibility to reach the interior of city blocks, as it should be noted that realization of connections to block can be very varied. A 200-fibre cable would be enough to cover subscribers of a block and possible municipal services. But as, overdimensioning the cable has a very low incremental cost, we have opted for a standard cable 288 fibres.

As already mentioned, most homes in Barcelona do not have the TCI project, this means that they do not have a telecom room. The solution proposed to this deficiency is the NAP room. Providing available space for these rooms to habited buildings is not easy, therefore a NAP for every four blocks is proposed, instead of the typical telecom room for each building. The dimensions of the NAP should be at least 12 m², to install 4 racks of 42 units each. The first two

racks with a capacity to 2000 fibres would be used by subscribers of the four blocks that would average 1600 subscribers. The third rack would be used by the distribution segment fibres. The fourth rack would be reserved for service operators, for equipment installation. The location of these NAPs will be mainly in municipal facilities such as parkings, civic centres, districts, etc.

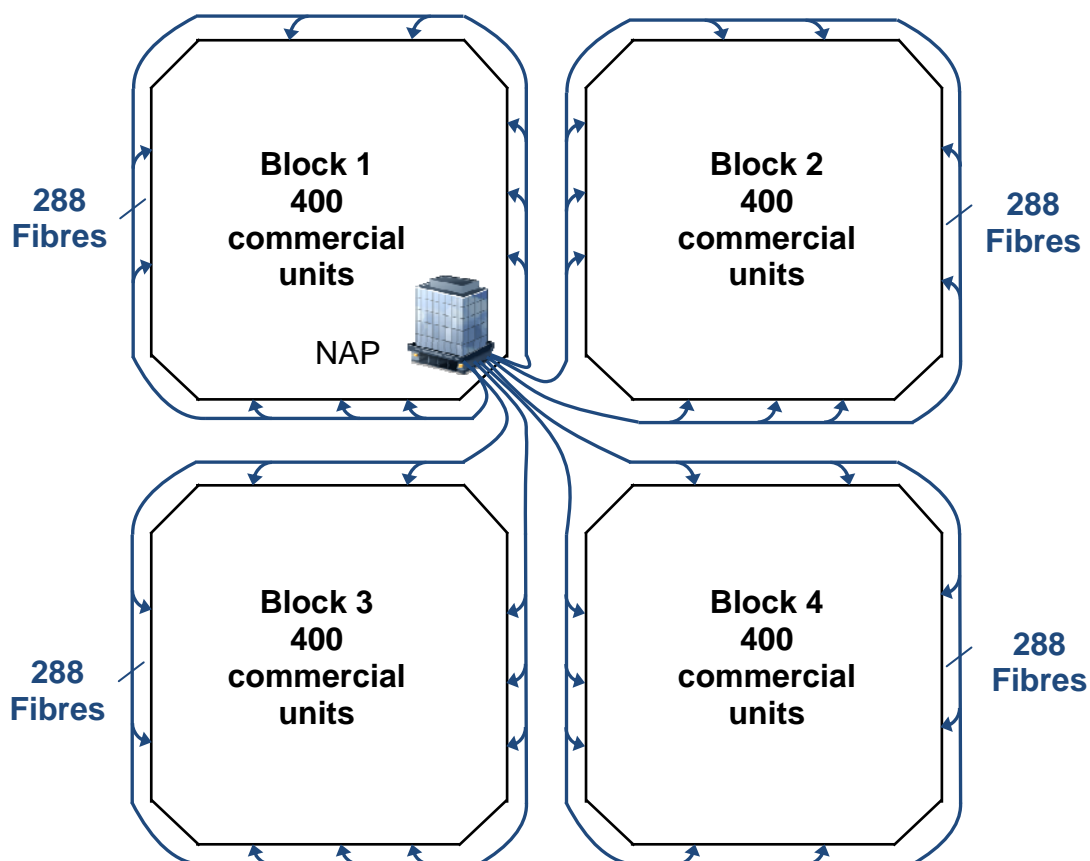


Fig. 18 Topology of Drop network segment

2.3.2. Distribution network segment dimensioning

The distribution segment connects the LCP to NAPs. This network segment is designed in a ring topology, which adds flexibility, redundancy and robustness to the network.

Dimensioning is performed to arrive on average 48 fibres to each NAP, and this over dimensioning will allow more flexibility if operators choose to install PON technology. Assuming that on average each operator requests 8 fibres for NAP, the network will be able to supply up to 6 operators. In the business plan, the

neutral operator may provide fibre to more than 6 service operators, because not everyone will be able to reach 100% of the demand.

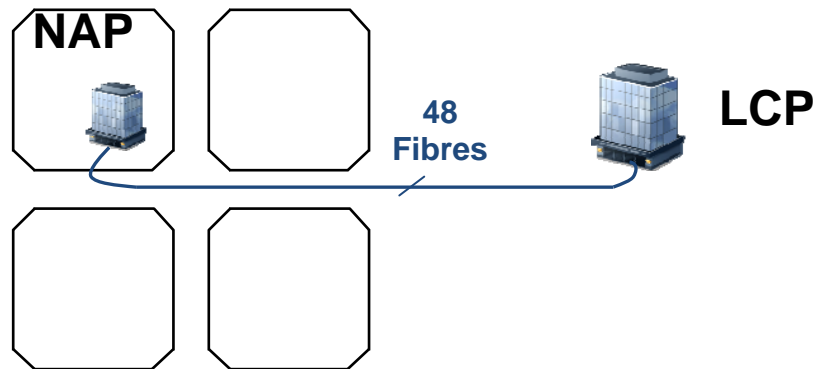


Fig. 19 Average of fibres per NAP from the corresponding LCP

Figure 19 shows that each NAP has an average of 48 fibres from their corresponding LCP. As demand will not be the same for all NAPs, due to the non-homogeneity of demand, the number of fibres requested by operators may vary according to their needs. This non-homogeneity will be resolved by implementing a ring topology, which will open up depending on demand.

Distribution segment network rings consist of 2 cables of 288 fibres that connect groups of 12 NAPs, as shown in the figure 20.

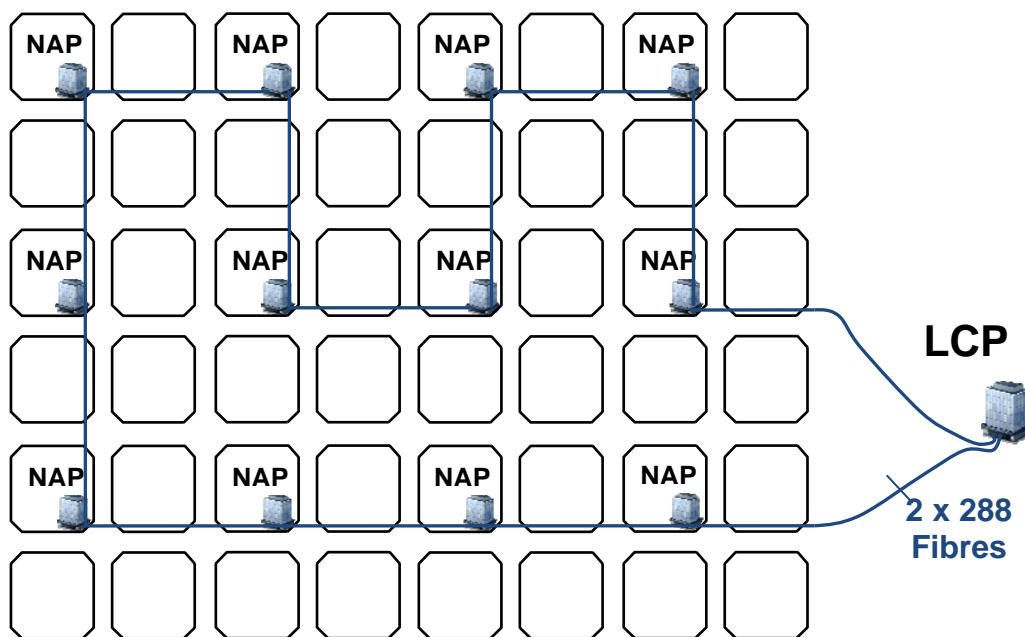


Fig. 20 Topology of Distribution network segment

A LCP includes groups of 12 NAPs by its respective rings. LCP dimensions will depend on the number of linked NAP groups. It is considered that for every group of 12 NAPs, a minimum of 18 m² is necessary. The location of these LCPs will be mainly in municipal facilities such as parkings, civic centres, districts, etc.

2.3.3. Feeder network segment dimensioning

The feeder segment network goes from LCPs to Hubs/Headends. This segment is solved for most telecom operators in the city of Barcelona, but there are other small operators and new entrants, that will need these connections. This segment is also indispensable, because it will connect the hubs/headends of the city such as the Carrierhouse located in the Zona Franca, the Catnix located near the UPC campus North or the Insitut d'Infomàtica Municipal (IMI) to the LCPs.

2.4. Civil works network dimensioning

Civil works are the biggest part of the budget that is needed to invest in a network of this type, when the ducts should be buried. The aerial case is not considered because it is deployed inside a high urban place, and aerial deployment is forbidden by the City Council of Barcelona. It should be considered in other places, with smaller density, and if the City Council agrees an aerial roll out might be a good solution to reduce the final cost of the project. Another sort of methodology is Mini-ditch, which is 45% cheaper than the conventional ditch. But the Mini-ditch solution cannot be applied in Barcelona because the amount of services that city has underground. Therefore the civil work will be done with a conventional ditch solution.

The dimensioning is done based on fibre needs discussed in the previous section. The topology, taking into accounts the urban characteristics of Barcelona and design of rings. The following figure shows the civil works network.

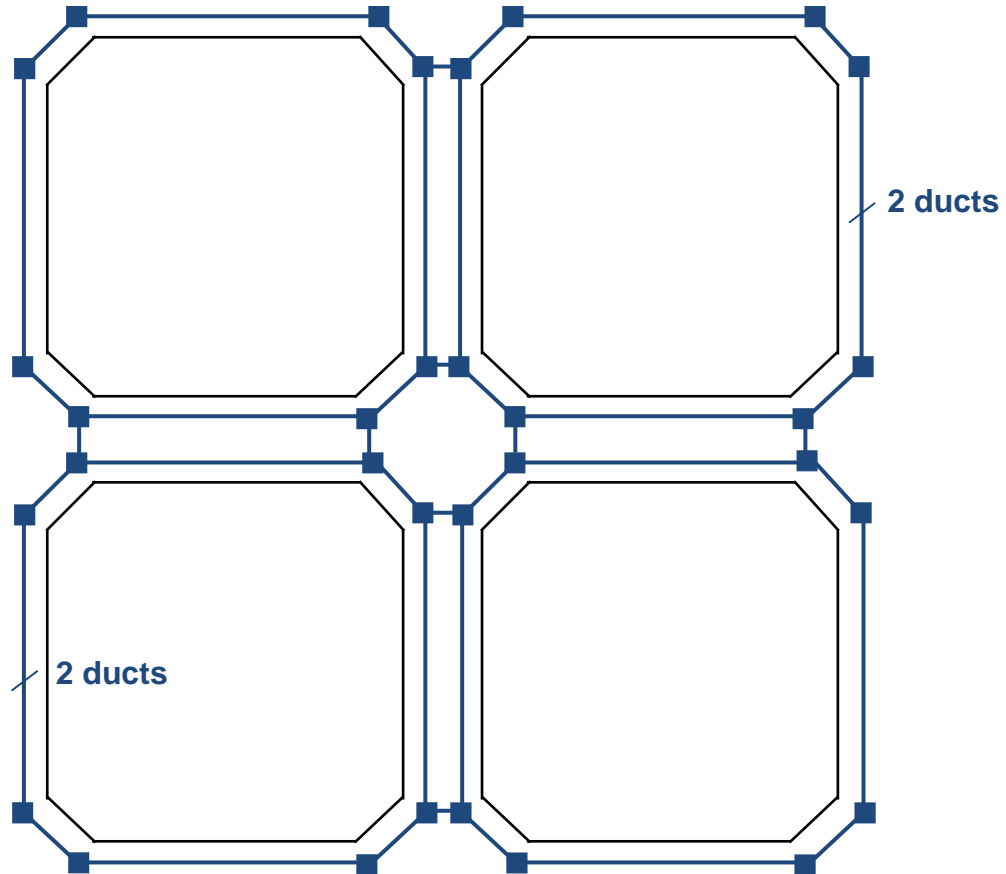


Fig. 21 Topology of civil works network

With the fibre dimensioning that has been done before, a single duct of 110 mm diameter and three ducts of 40 mm diameter inside of the 110 duct would be sufficient. But this dimensioning could represent a big risk to face unforeseen circumstances as clogged ducts or cases of demand concentration.

The following table shows the cost of installation ducts to road and sidewalk.

Table 5. Ducts installation

	SidewalkSidewalk	Road
1 duct	59,05 €/ m	109,66 €/ m
2 ducts	74,28 €/ m	124,75 €/ m

In Table 5, two important conclusions are drawn. The first one being that installing ducts is more expensive in a road than in a sidewalk, this is because the road ducts must be buried deeper than the sidewalk, and that replacement tar is much more expensive than replacement street tile. Therefore, whenever possible ducts will be installed in the sidewalk.

The second conclusion drawn is that the price difference to install a single tube or a pair is not significant and the benefits of having a spare duct are numerous. Therefore network dimensioning is projected with two ducts, except in short lengths connections to buildings with low customer density.

CHAPTER 3. BUSINESS MODEL

3.1. Service offering

Telecommunications services are usually identified as a user receives service. That is, telephone service, Internet access, mobile communications, etc. However, the value chain of a telecom operator is divided into three levels:

- Passive infrastructure: consisting of ducts and passive elements such as fibre optics.
- Connectivity service or active infrastructure: consisting of active equipment that carry data that operators use to transmit services.
- Final Service: formed by the information that configures the service, i.e., numbering and phone connectivity, IP traffic which allows users to access the Internet, etc.

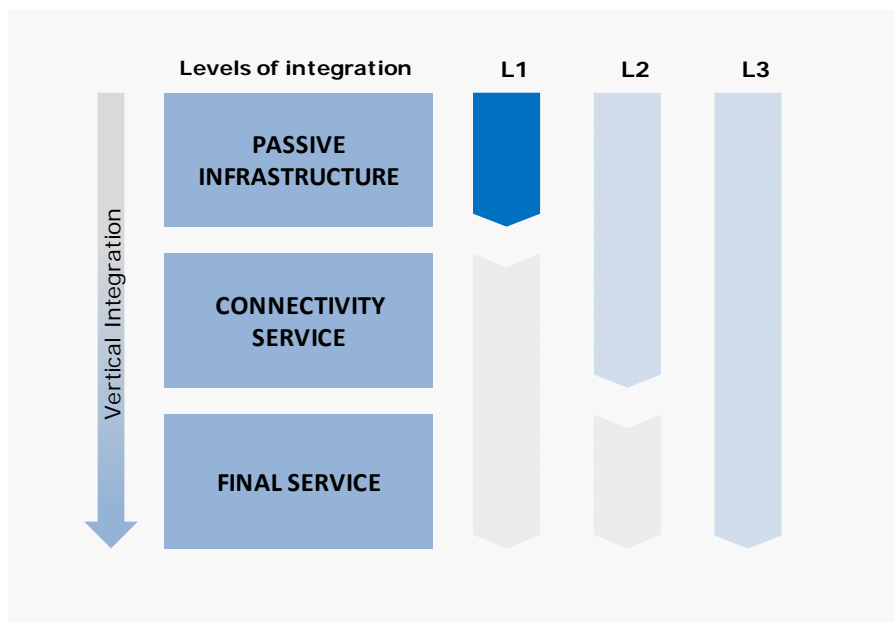


Fig. 22 Service levels

The services offered by the operator are focused only on the passive level, ie only in the marketing of passive elements, such as fibre.

3.2. Reference pricing

Currently in the telecommunication market there are offers of passive infrastructure services. The following offers have been made by public and private operators, which are named below the cases analyzed in this project.

The first case is in Asturias where Asturcón Network is a fiber to the home (FTTH) network with GPON technology operated by a public company of Asturian government, which provides bitstream capacity from the operator's access point to network terminal in the user's home. Through this connectivity, operators can offer their customers voice and data services.

The monthly rental fee for bitstream service is 15,95 € and for registration 35 €, all prices excluding VAT.

The Swedish market has also been examined. The fees of 36 neutral operators who rent the fibre optic network in Sweden have been analyzed. As in the case of Asturcón, the rent includes electronics, horizontal and vertical network (bitstream service).

The average monthly fee of these operators is 12,81 €. Most operators don't apply a registration fee. Of the operators that charge the registration fee, the average of this fee is of 21,28€, not including VAT.

Other reference pricing to take into account, despite being copper based, is the one that had been set by the CMT for the rental of the Subscriber Loop Offer (SLP), which cost is set at 13,97€.

Finally the pricing of dark fibre operator of 22@Barcelona has been analyzed. This municipal operator has a price-oriented sector for companies and recently has also stipulated a price for the residential sector. In the business sector it operates with flat rates using a series of discounts based on different criteria based on characteristics of the district. In the rates charged residential sector, there are fees for subscriber both for the horizontal and vertical network.

Taking into account that the pricing of the 22@Barcelona municipal operator, is oriented at obtaining an economic return, and that these prices are in line with prices of other operators it makes sense to use the same prices as the municipal operator to have a homogenous municipal fee.

3.3. Potential Customers

The availability of infrastructure is aimed at the entire market of electronic communications operators. However, there are four major types of needs, some of them immediately.

- Xarxa Oberta in Barcelona: as mentioned above, this project would be the first opportunity for the marketing of fibre optic infrastructure. Specifically, the goal would be the connection of 70 buildings of the Catalan Government in Barcelona.
- Connecting the locations of the mobile network: the evolution of mobile telecommunications, especially in mobile data demand. Mobile telecommunication operators require a fibre optic connection to existing mobile locations.

Therefore, other potential customers of this network are the current wireless network operators.

- Next Generation Network of fibre to the home / business: currently providing broadband services in the city is done mainly through the network of Telefónica's copper pairs (xDSL) and the coaxial network of ONO.

The evolution in speeds and services as well as the introduction of high definition TV over IP, requires the development of technology supported in the optical fibre to the home (FTTH).

Potential customers of this infrastructure are currently the operators providing electronic communications services using xDSL services, and operators providing telecommunication services to the small and medium businesses.

- Connectivity to the city: Self-provision services are increasing in the city. These services will enable more efficient management of public services for the city and provide it with better communication and service (Smart Cities).

Virtually all areas of the city are and will be customers of the infrastructure.

These business opportunities can be sorted and prioritized temporarily in different periods for our business plan. The following figure, figure 23, represents an estimate for different periods of each of the opportunities mentioned.

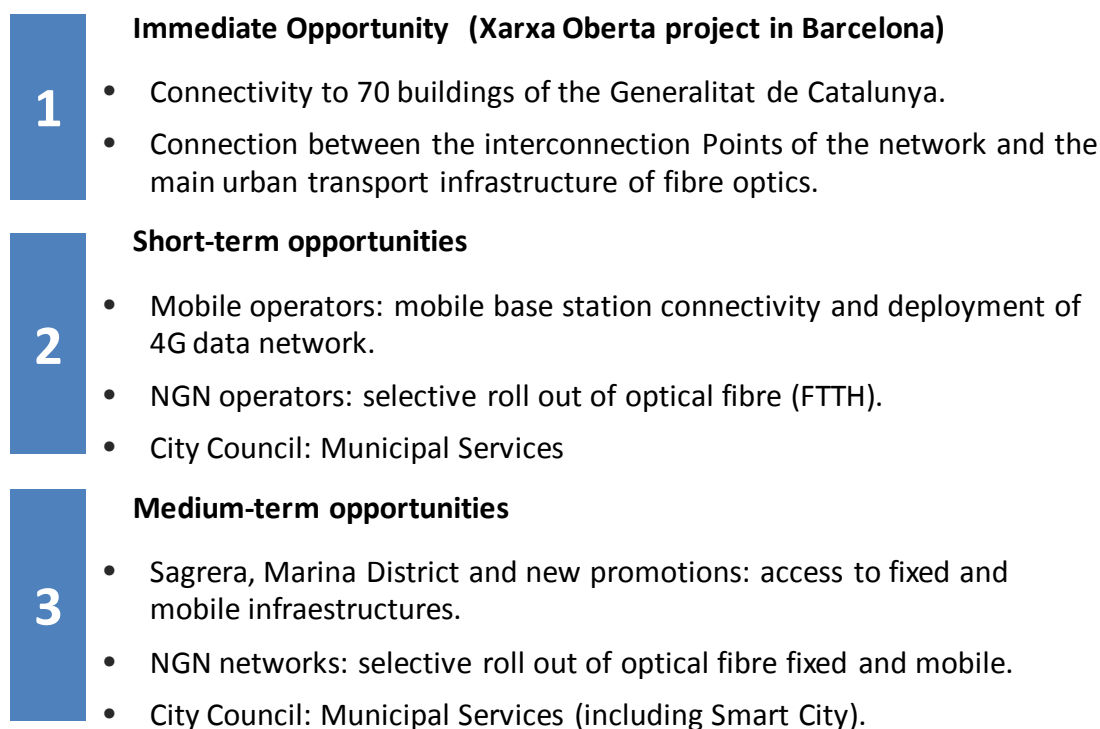


Fig. 23 Commercial opportunities

The following figure, Figure 24, shows the current map of telecommunications operators in the market, differentiating the business scope and own infrastructure they have. This does not include the incumbent operator because its model is completely vertical and this would not be a potential customer for the neutral operator.

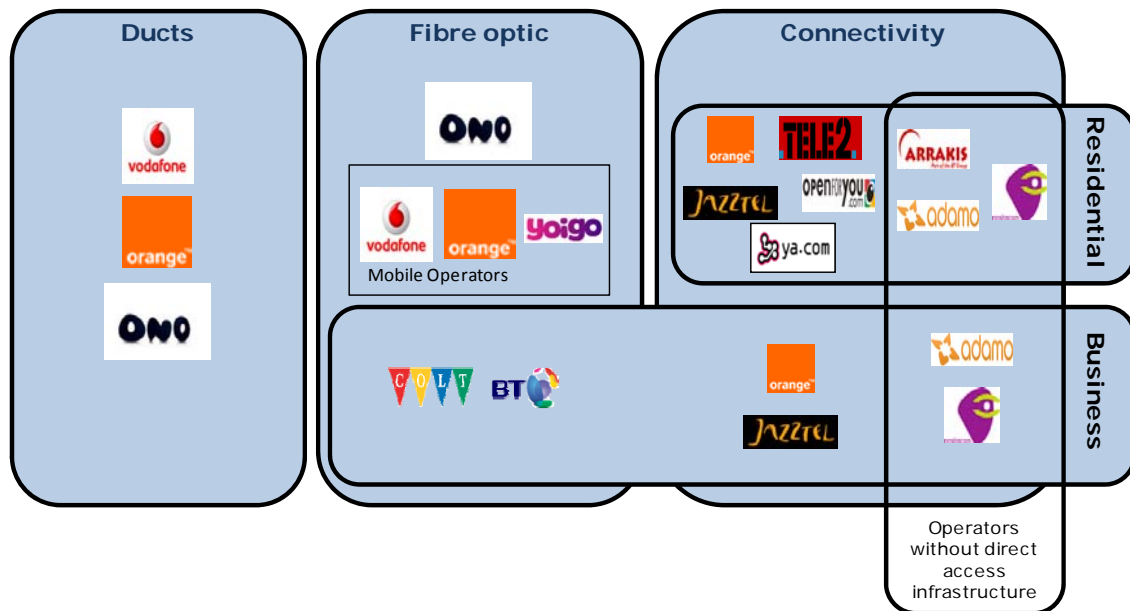


Fig. 24 Potential customers

3.4. Service catalogue

After identifying potential customers and the level at which the neutral operator will market its services, even if only passive elements, there may be different modalities. This section describes the range of services that the neutral operator may offer in urban dark fibre market, with its various forms, pricing and SLA's.

3.4.1. Pricing

In this section the fees that the neutral operator will commercialize are presented. These consist of a registration fee and a monthly fee, depending on the different modalities offered by the neutral operator.

3.4.1.1. Residential sector

- Registration fee:

To register a new subscriber, a fee will be applied. This concept corresponds mainly to the remuneration of the work necessary to perform the physical interconnection and displacement of workers. The price proposed is as follows:

Table 6. Registration fee for the residential market of the Drop and the Distribution network segment

Residential Registration Fee
35,51 € per subscriber

- Rental fee:

The base fee for renting the horizontal network per subscriber, between the NAP and the ONT, to apply is as follows:

Table 7. Monthly rental fee for the residential market of the Drop and the Distribution network segment

Residential Monthly Rental Fee
5,49 € per subscriber

In the Drop network segment, one fibre per subscriber will be provided, while in the Distribution network segment each operator will have four fibres for each NAP. These four fibres will be the same as the business sector and the SLA to apply will always be the most restrictive.

As for the Vertical network of buildings, the neutral operator only provides installation of the Vertical network in buildings with TCI, which in Barcelona are only 3.53% of existing buildings. The cost of installation of this Vertical network is expected to be 100 € per home. The price proposed is as follows:

Table 8. Monthly rental fee for the residential market of the Vertical network segment

Residential Monthly Rental Fee
5,15 € per subscriber

3.4.1.2. Business sector

- Registration fee:

As for the business sector, the registration fee will be slightly above the residential sector, because in this case a redundant connection will always be provided.

Table 9. Registration fee for the business market of the Drop and the Distribution network segment

Business Registration Fee
54,55 € per subscriber

- Rental fee:

The base fee for renting the horizontal network per subscriber, between the NAP and the ONT, is higher in the business sector than residential sector for two reasons. The first reason is that in this sector a redundant physical connection will always be provided. The second reason is that the SLA will be offered is better than the residential sector. Within the business sector there are two different subsectors, the basic and premium mode, for which the SLA differs. The price proposed is as follows:

Table 10. Monthly rental fee for the business market of the Drop and the Distribution network segment

Basic Mode Monthly Rental Fee	Premium Mode Monthly Rental Fee
34,30 € per subscriber	86,50 € per subscriber

In the Drop network segment it will provide two fibres per subscriber, while in the Distribution network segment each operator will have four fibres for each NAP. These four fibres will be the same as the residential sector and the SLA to apply will always be the most restrictive.

3.4.1.3. P2P sector

- Registration fee:

The registration fee for a point to point (P2P) connection on any network segment, the price proposed is as follows:

Table 11. Registration fee for the P2P market

P2P Registration Fee
262,44 €

This amount relates mainly to the remuneration of the work necessary to perform the physical interconnection and displacement of workers.

- Rental fee:

The lengths of these connections can vary significantly depending on the needs of the service operators. A flat fee is proposed, to homogenize the territory. In this type of P2P connection, it will be 2 pairs of fibres, the second pair will be to provide a redundant connection.

The fee for renting this connection is the following:

Table 12. Monthly rental fee for the P2P market

P2P Monthly Rental Fee
400 € per connection

In the case of mobile operators, taking into account that they usually connect their mobile stations in rings, it seems reasonable to use this connection type.

3.4.1.4. Services included in rental fee

The fees include the fibre optics rent, the network maintenance in accordance with the SLAs described in section 3.4.2., and also include the rental of space in technical rooms where service operators may install their electronic equipment. The operators that will need an electrical connection must apply the power supply to the electric company, taking charge of all costs.

3.4.2. Service level agreement (SLA)

In this section is described the proposal SLA, where according to the different types of connections will be an SLA in terms of availability of service.

The incidences must be reported by service operators. The period during which the service was not available will be measured from the time that this incidence has been reported by the service operator, until it is resolved.

Therefore, the SLA is measured as follows:

$$SLA = 1 - \left(\frac{\text{Annual hours without service}}{\text{Hours in a year}} \right) \quad (3.1)$$

The following table shows the expected maximum time to solve the incidence in terms of each mode contracted by the service operator and the corresponding SLA:

Table 13. SLA in function of the sector

Sector	Maximum time out of service a year	SLA
Residential	24 hours	99,72%
Basic Business	12 hours	99,86%
Premium Business	4 hours	99,95%
P2P	4 hours	99,95%

If SLA is not carried out, the service operator is entitled to claim compensation, as detailed in the following table:

Table 14. Compensation scales

Hours exceeded per incidence	Compensation, % of monthly rent affected
0-3	5 %
3-4	10 %
4-6	15 %
over 6	20 %

The planned outages will not be entitled to compensation.

Due to network design rings, the neutral operator will offer almost always two different physical paths, so that in most cases, the interruption of service at a path will not imply the interruption of service to the end user.

3.4.3. Summary of the service catalogue

The following table summarizes the service catalogue of the neutral operator:

Table 15. Service catalogue

Sector	Registration Fee	Monthly rental Fee	Redundant physical path	SLA
Residential	35,51 € per subscriber	5,49 € per subscriber (Horizontal network) 5,15 € per subscriber (Vertical network)	No	99,72%
Basic Business	54,55 € per subscriber	34,30 € per subscriber	Yes	99,86%
Premium Business	54,55 € per subscriber	86,50 € per subscriber	Yes	99,95%
P2P	262,51 € per subscriber	400,00 € per connection	Yes	99,95%

3.5. Management model

The goal of the neutral operator is to put the available telecommunications infrastructure on the market and this requires a management model.

The neutral operator positioning will be between the City Council and service operators as shown in the following figure.

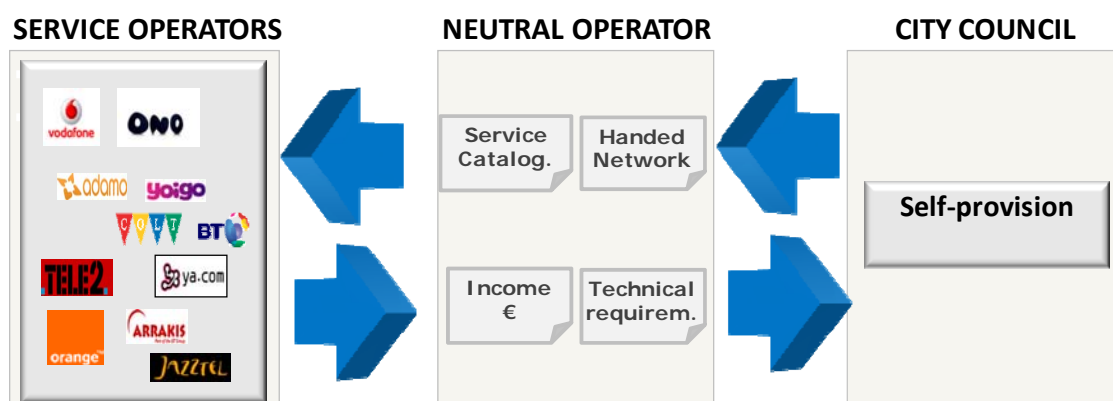


Fig. 25 Management links

Management of the neutral operator can be in three different ways, public, private or through public-private partnership.

In the case of public management, the assets are public and commercial and operational exploitation are also public. An example of this is the public company 22@Barcelona.

If management is private, the assets are public and commercial and operational exploitation is done by a private operator. This model applies when the public administration wants a private operator to manage, but the private operator does not provide investment or infrastructure. In this model the benefits of commercial exploitation revert to the city.

The third model is that of public-private partnership, which would be applicable when the public administration wants to complement existing infrastructure with additional infrastructure, which will be provided by a private or will be built by the private sector. The private entity gets a concession of technical and commercial exploitation of the network, where it gets the benefits of exploitation during a certain period, after which it must share the benefits with the City Council. The infrastructures will revert to the city in the termination of the concession.

The following figure shows the three possible management models:



Fig. 26 Management models

3.6. Business plan

This section describes the following parts of the business plan, as the deployment plan, the investment to be made, source of incomes, amortization and expenditures.

3.6.1. Deployment plan

At this point the deployment plan is exposed, that makes it possible to provide a next generation telecommunication infrastructure for 400 Example city blocks over a period of 25 years. Due to the characteristics of the project, the deployment of infrastructure is planned by city block units per year, with the exception of some specific point to point connections, which may be required by the Xarxa Oberta project. The following figure shows the deployment plan for the neutral operator.

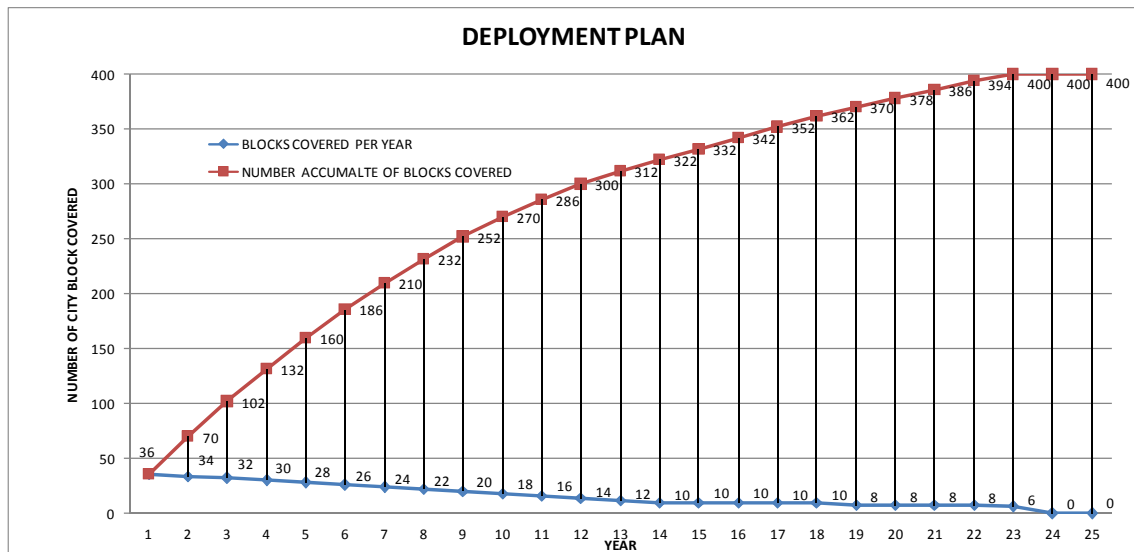


Fig. 27 Deployment plan to 25 years

3.6.2. Investment

Fibre investment that includes roll out of fibre into the ducts, civil works that includes ducts and manholes in the streets, and the adequacy of the technical rooms, are known as capital expenditures (CAPEX). All are investments that can be amortizable each year in the company balance sheets as will see in the section on amortization.

Regarding civil works, these basically consist of manholes and ducts (1 or 2 tubes) that will be installed in the sidewalk and road. These items include the cost of supplies and workforce. To these items the following concepts must be added: Safety and Health (2.5%), General Expenses (13%), Industrial Profit (6%), Quality Control (2%) and Project Management (8%). The following table shows the detailed amount of civil works per city block without taking into account any use of existing municipal infrastructure.

Table 16. Civil works cost per city block

TOTAL INVESTMENT OF CIVIL WORKS PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Duct on the footpath (1 tube)	m	240,00	59,05 €	14.172,00 €
1.02	Ducts on the footpath (2 tubes)	m	488,00	74,28 €	36.248,64 €
1.03	Ducts on the road (2 tubes)	m	40,00	124,75 €	4.990,00 €
1.04	Manhole	Ut	12,00	785,72 €	9.428,64 €
3.01	Subtotal				64.839,28 €
1.05	Safety and Health	pa	2,5%		1.620,98 €
3.02	Total Budget Material Execution				66.460,26 €
1.06	General Expenses		13,0%		8.639,83 €
1.07	Industrial Profit		6,0%		3.987,62 €
3.03	Subtotal				79.087,71 €
1.08	Quality Control	pa	2,0%		1.296,79 €
1.09	Services Affected	pa	7,0%		4.538,75 €
1.10	Project Management	pa	8,0%		5.187,14 €
5.01	TOTAL BUDGET PER CITY BLOCK				90.110,39 €

The optomechanical installation consists of cables, boxes and distribution racks. These items include the cost of supplies and. To these items the following concepts must be added: Safety and Health (2.5%), General Expenses (13%), Industrial Profit (6%), Quality Control (2%) and Project Management (8%). The following table shows the detailed amount of optomechanical installation per city block without taking into account any use of existing municipal infrastructure.

Table 17. Optomechanical installation cost per city block

TOTAL INVESTMENT OF FIBRE PER CITY BLOCK					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Fibre Splices	Ut	220,00	15,54 €	3.418,80 €
1.02	Fibre optic cable up to 24 FO	m	65,00	6,81 €	442,65 €
1.03	Fibre optic cable up to 48 FO	m	65,00	7,32 €	475,80 €
1.04	Fibre optic cable up to 144 FO	m	130,00	12,61 €	1.639,30 €
1.05	Fibre optic cable up to 288 FO	m	720,00	17,92 €	12.902,40 €
1.05	Tube of polyethylene 40 mm	m	3.888,00	1,26 €	4.898,88 €
1.06	Splices Box	Ut	4,00	374,00 €	1.496,00 €
1.07	Distribution Racks	Ut	0,25	427,00 €	106,75 €
3.01	Subtotal				25.380,58 €
1.08	Safety and Health	pa	2,5%		634,51 €
3.02	Total Budget Material Execution				26.015,09 €
1.09	General Expenses		13,0%		3.381,96 €
1.10	Industrial Profit		6,0%		1.560,91 €
3.03	Subtotal				30.957,96 €
1.11	Quality Control	pa	2,0%		507,61 €
1.12	Project Management	pa	8,0%		2.030,45 €
5.01	TOTAL BUDGET PER CITY BLOCK				33.496,02 €

The following table shows the total investment to be made per city block in the case that would not be possible take advantage of existing municipal infrastructure.

Table 18. Infrastructure cost per city block without taking advantage of existing municipal infrastructure

	Investment cost per city block
Civil works	90.110,39 €
Fibre	33.496,02 €
TOTAL	123.606,41 €

The following figures shows the percentages that represent the civil engineering infrastructure and the optomechanical installation related to the total cost of investment.

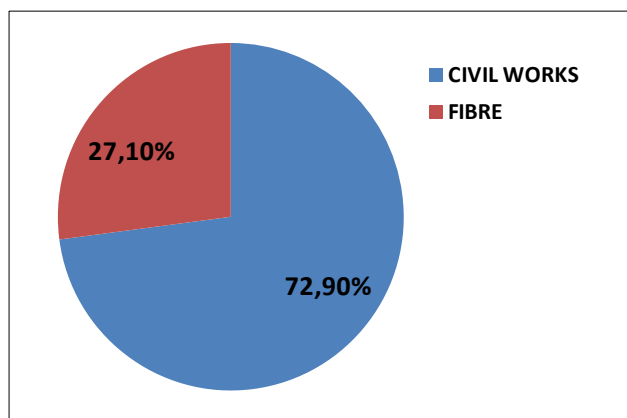


Fig. 28 Percentage of investment (Civil works and Fibre)

In Chapter 1, a large number of existing municipal infrastructure is showed the, and also the problem that there isn't inventory to quantify it. Because of this reason, in this project three models of estimation have been implemented: optimistic, intermediate and pessimistic, where to each a different percentage is applied. The following table shows these percentages:

Table 19. Use percentage according the estimate model

	Use percentage of existing municipal infrastructure		
	Optimistic model	Intermediate model	Pessimistic model
Civil works	15%	10%	5%
Fibre	7,5%	5%	2,5%

Applying this percentage, the investment cost per city block will vary depending on the model, as shown in the following table:

Table 20. Investment cost per city block according to the estimated model

	Investment cost per city block			
	Without application	Optimistic model	Intermediate model	Pessimistic model
Civil works	90.110,39 €	76.593,83 €	81.099,35 €	85.604,87 €
Fibre	33.496,02 €	30.983,82 €	31.821,22 €	32.658,62 €
TOTAL	123.606,41 €	107.577,65 €	112.920,57 €	118.263,49 €

This project includes 400 Eixample building blocks, which are approximately the number of blocks that Barcelona has in its uniform town plan. The model could be extended to other areas of the city with different urban topologies, but this would not add great value to the project.

If the total investment that should be made to cover these 400 city blocks is calculated, applying the three models mentioned above, the result is the following:

Table 21. Investment cost for 400 city blocks according the estimate model

	Investment cost for 400 city blocks			
	Without application	Optimistic model	Intermediate model	Pessimistic model
Civil works	36.044.156 €	30.637.532 €	32.439.740 €	34.241.948 €
Fibre	13.398.408 €	12.393.528 €	12.728.488 €	13.063.448 €
TOTAL	49.442.564 €	43.031.060 €	45.168.228 €	47.305.396 €

Finally, the investment for adaptation of rooms, despite being a smaller investment than the rest, is just as necessary. This investment consists of making the rooms fit for the use of telecommunications. Adequacy of the electrical installation, a cooling system if necessary, installation of racks and any partitioning. The estimated cost for adaptation a room is shown in the following table:

Table 22. Investment cost for the adaptation of the room

Investment cost per room
18.000 €

The total project investment that will be realized during the 25 years of the business plan will be invested as follows, see Figure 29.

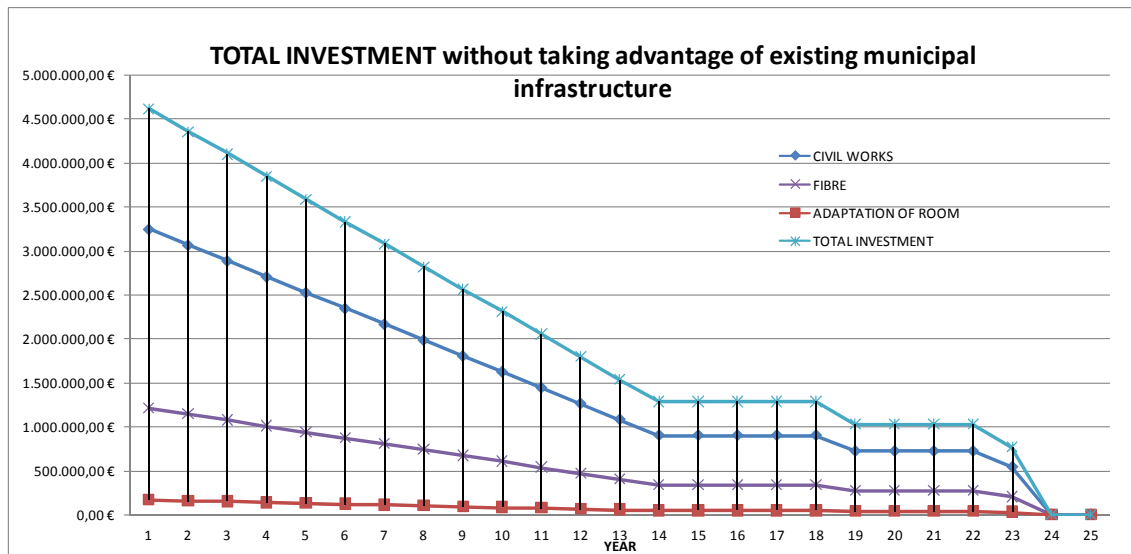


Fig. 29 Investment during 25 years

3.6.3. Incomes

As stated in section 2.2, an Eixample type block has an average of 400 commercial units, 345 of which are homes, 30 business premises and 25 industrial premises. Two different markets were identified: the residential market and the business market. These markets and other sectors with a lower impact should then be analyzed.

3.6.3.1. Residential sector incomes

According to the survey conducted by the National Statistics Institute (INE) on IT to homes, 57,4% of homes in Spain have a broadband connection to the Internet, which was 11,6% more than in 2009. And the autonomous community with the highest percentage of homes with Internet access is Catalonia with 68,3%.

Therefore, it is assumed that the percentage of homes connected will be 70%. Taking into account that the rate penetration increases year after year, this is a conservative estimate, thus taking as few risks as possible.

Table 23. Hypothetical percentage of homes with Internet connection

Assumption of homes with connection
70%

On the other hand, there must be taken into account that this percentage will not be the rate of penetration of the neutral operator, because not all service operators will rent the fibre from the neutral operator.

The penetration of connections in homes that the service operators will have is difficult to predict. Because of this reason, three scenarios are created: optimistic, intermediate and pessimistic. It is assumed that they will be 80%, 65% and 50% respectively, of all operators providing service in homes. This does not include the incumbent operator.

These percentages may seem initially high in the current market based on the copper network. But taking into account that the future market for fibre networks will promote the competition, these percentages proposed are reasonable in an equitable market. The following table shows the possible operators that have been exposed in section 3.3, with their potential market.

Table 24. Estimated percentage of residential market penetration

Residential customers	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Orange – Tele 2	17%	13,8%	10,5%
Ono	17%	13,8%	10,5%
Jazztel	17%	13,8%	10,5%
Ya.com	12%	9,8%	7,5%
Adamo	12%	9,8%	7,5%
Other	5%	4,3%	3,5%
Total percentage of market penetration	80%	65%	50%

Applying the residential fees that have been described above, the prediction incomes per city block in will be the next:

Table 25. Prediction incomes residential sector

	Residential sector		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Annual rental incomes per city block	13.149,49 €	10.683,96 €	8.218,43 €
Registration incomes per city block	6.860,53 €	5.574,18 €	4.287,83 €

3.6.3.2. Business sector incomes

According to the survey conducted by the National Statistics Institute (INE) on IT to the companies in state-wide. The 97,2% of Spanish companies with ten or more employees have Internet access, and for companies with less than ten employees this percentage is 58,1%.

Following the minimum expectations, it is assumed that the percentage of connected companies will be 60%.

Table 26. Hypothetical percentage of business with Internet connection

Assumption of business with connection
60%

On the other hand, there must be taken into account that this percentage will not be the rate of penetration of the neutral operator, because not all service operators will rent the fibre from the neutral operator.

In the business market also three scenarios are created: optimistic, intermediate and pessimistic. It is assumed that the service operators will have 80%, 65% and 50% of business market penetration respectively. The following table shows the possible operators that have been exposed in section 3.3, with their potential business market.

Table 27. Estimated percentage of business market penetration

Business customers	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Orange	15%	12,3%	9,5%
Colt	15%	12,3%	9,5%
Ono	15%	12,3%	9,5%
Jazztel	12%	9,8%	7,5%
BT	10%	8,0%	6%
Adamo	8%	6,5%	5%
Other	5%	4,0%	3%
Total percentage of market penetration	80%	65%	50%

Applying the business fees that have been described above, the prediction incomes per city block in will be the following:

Table 28. Prediction incomes business sector

	Business sector		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Annual rental incomes per city block	19.134,72 €	15.546,96 €	11.959,20 €
Registration incomes per city block	1.440,12 €	1.170,10 €	900,08 €

3.6.3.3. P2P sector incomes

Another source of income to be considered, is due to P2P mode that the neutral operator provides. This P2P sector is divided into three types of customers: mobile phone operators, the operator of the Network of Xarxa Oberta and a third group call other customers.

In the case of mobile operators, also three estimate models are applied, considering that each of the potential mobile operators will have a mobile base station connected by groups of city blocks in function of the following table:

Table 29. Group of blocks with connected base station

P2P customers (mobile phone operators)	Optimistic estimate (number of blocks for each station)	Intermediate estimate (number of blocks for each station)	Pessimistic estimate (number of blocks for each station)
Vodafone	9	12	16
Orange	9	12	16
Yoigo	9	12	16

With the previous estimates the following income for this market sector for each city block is expected:

Table 30. Prediction incomes P2P mobile phone

	P2P sector (mobile phone operators)		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Annual rental incomes per city block	1.600 €	1.200 €	900 €
Registration incomes per city block	87,48 €	65,61 €	49,21 €

Another potential customer that has been analyzed in the first chapter is the telecommunication operator of the Catalan Government, known as the Xarxa Oberta project. The estimation of incomes for this customer is the next:

Table 31. Prediction incomes P2P Xarxa Oberta

	P2P sector (Xarxa Oberta Project)		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Connected buildings	70	50	35
Annual rental incomes	336.000 €	240.000 €	168.000 €
Registration incomes	18.370,80 €	13.122,00 €	9.185,40 €

The third group of this sector is defined as other customers. This will be very specific and varied connections of different operators, thus an approximation of demand is presented in the following table:

Table 32. Number of connections per block P2P other customers

	P2P sector (Other customers)		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Number of connections per city block	0,5	0,3	0,15

With the previous estimates it is expected the following incomes for this market sector for each city block:

Table 33. Prediction incomes P2P other customers

	P2P sector (Other customers)		
	Optimistic estimate	Intermediate estimate	Pessimistic estimate
Annual rental incomes per city block	2.400 €	1.440 €	720 €
Registration incomes per city block	131,32 €	78,73 €	39,37 €

Other possible incomes would be the services of self-provision, where the customer is the City Council. Despite the income being justifiable, it becomes very difficult to quantify which is the return of this customer. One way to quantify this service and is considering a percentage of return on investment, which is included directly as income. But in this thesis possible incomes for self-provision have not been taken into account any, despite being aware of the real return of this concept, thus reinforcing the credibility of the business plan of this thesis.

3.6.3.4. Total incomes

The following figure shows the evolution of total incomes of the three models:

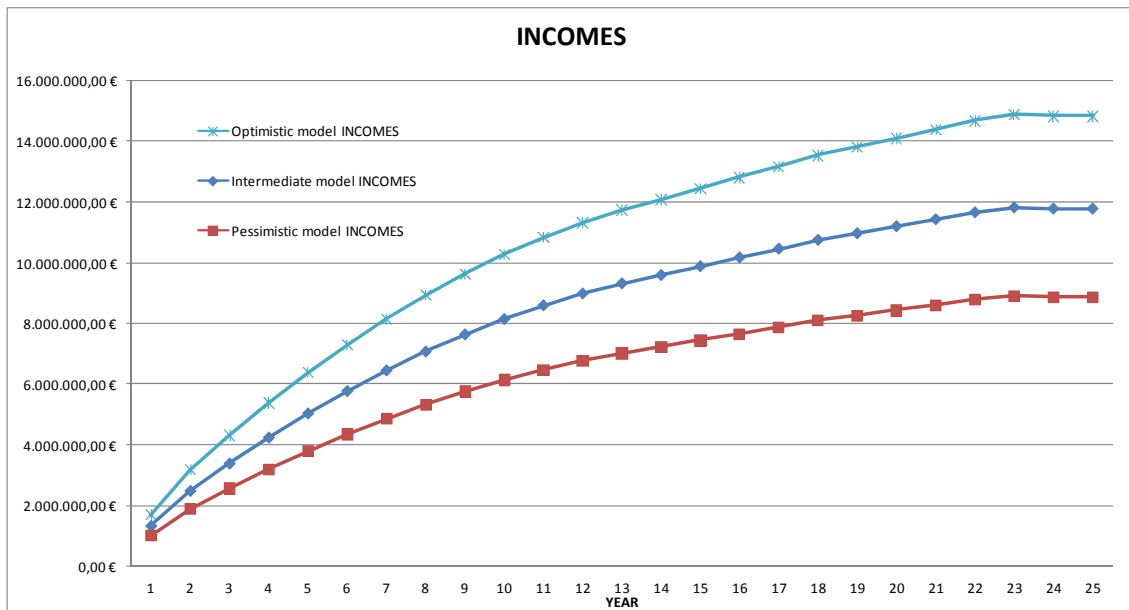


Fig. 30 Comparison of incomes between the three models

In the Annex I is detailed the tables of incomes.

3.6.4. Amortization

In section 3.6.2 the investment in fibre that includes roll out of fibre into the ducts, civil works that includes ducts and manholes in the streets, and the adequacy of the technical rooms has been presented. All are investments that can be amortized each year in the company balance sheets.

The economic amortization represents the depreciation of assets. But these assets, until they don't reach the end of their amortization must be considered fixed company assets. This depreciation will come motivated by reasons of physical depreciation caused by the passing of time or due to its usage.

The following table shows the lifecycle of the assets of reference:

Table 34. Amortization periods

Assets life	
Civil Works	50 years
Fibre (Optomechanical Installation)	25 years
Adaptation of telecommunication rooms	25 years

The following figure shows the evolution of amortization to 25 years, taking into account that there is no use of existing infrastructure.

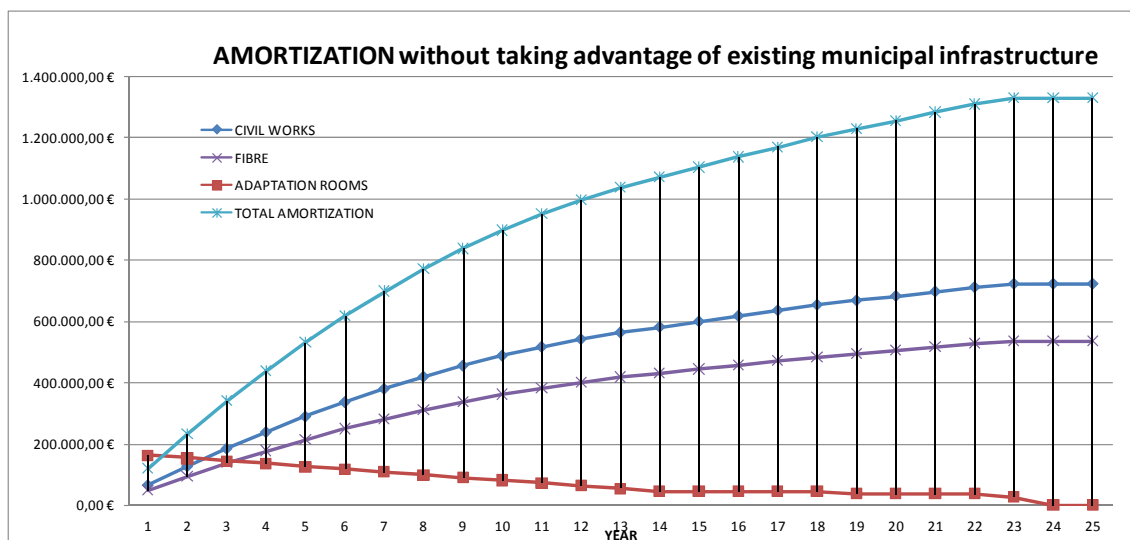


Fig. 31 Amortization to 25 years

Annex I includes the complete tables of amortization of these assets.

3.6.5. Expenditures

The operative expenditures known as OPEX include all costs attributable to preventive and corrective maintenance of the network, staff, rental of premises and other expenses.

3.6.5.1. Maintenance expenditures

This section includes preventive maintenance, reactive maintenance and team availability, of all fibre optic cables and infrastructure elements that constitute the network of neutral operator.

These three functions of maintenance are described below.

- Team availability:

This service consists of the permanent availability (24x7) of a team for immediate action, prepared to act in case of failure or suspected failure.

- *Preventive maintenance:*

Preventive maintenance is needed to detect possible weaknesses in infrastructure and prevent future incidents on the network. This maintenance involves the following tasks:

- Inspections of network elements and cables.
- Inspections of manholes and ducts.
- Measures of the links that form the backbone network.

- *Reactive maintenance:*

This involves checking and repair, if necessary, for the restoration of services affected by the incidence of the specific infrastructure. This maintenance involves the following tasks:

- Failure detection and repair.
- Interventions scheduled to realize tasks necessary repairs identified in preventive maintenance.

Maintenance costs are considered to be 2% of the investment.

3.6.5.2. Payroll expenditures

This item includes all payrolls of the neutral operator team, from administrative to technicians.

There would not be a large structure because most workers would be contracted. A team of seven people is proposed consisting of engineers, technicians, assistants and a manager.

The following table shows the most common internal procedures to be undertaken:

Table 35. Main internal procedures of the neutral operator

INTERNAL PROCEDURES
Application for fibre
Procedures for registration / cancel
Modification procedure paid service
Guarantee service procedure
Application for interconnection
Application for access and visits
Application for action tour
Application for space in the rooms

The proposed organization chart of the neutral operator is the following.

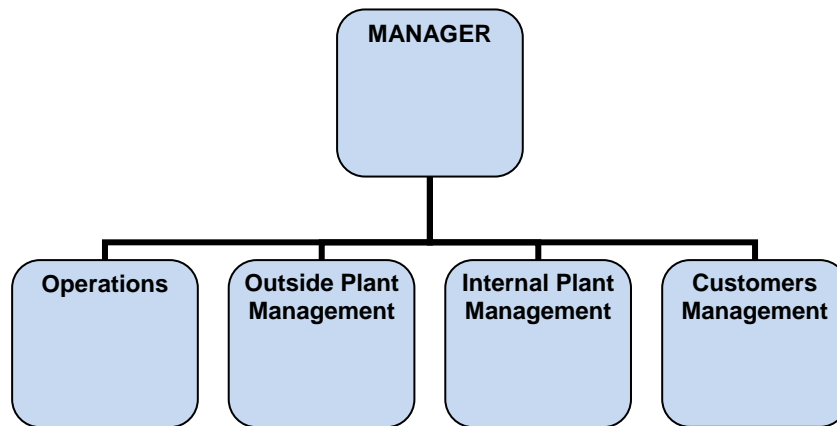


Fig. 32 Organization chart

The cost of this structure is expected to be 280.000€ annually.

3.6.5.3. Other expenditures

This model also takes into account various costs, such as fixed costs linked to the rent of facilities, insurances, consumption of electricity, gas and telecommunications.

It is estimated that the cost for this item will be 35.000 € per year.

3.6.5.4. Total expenditures

Concerning the total expenditure, the following figure shows the evolution of total expenditures during the 25 years of the business plan, taking into account that there is no use of existing infrastructure.

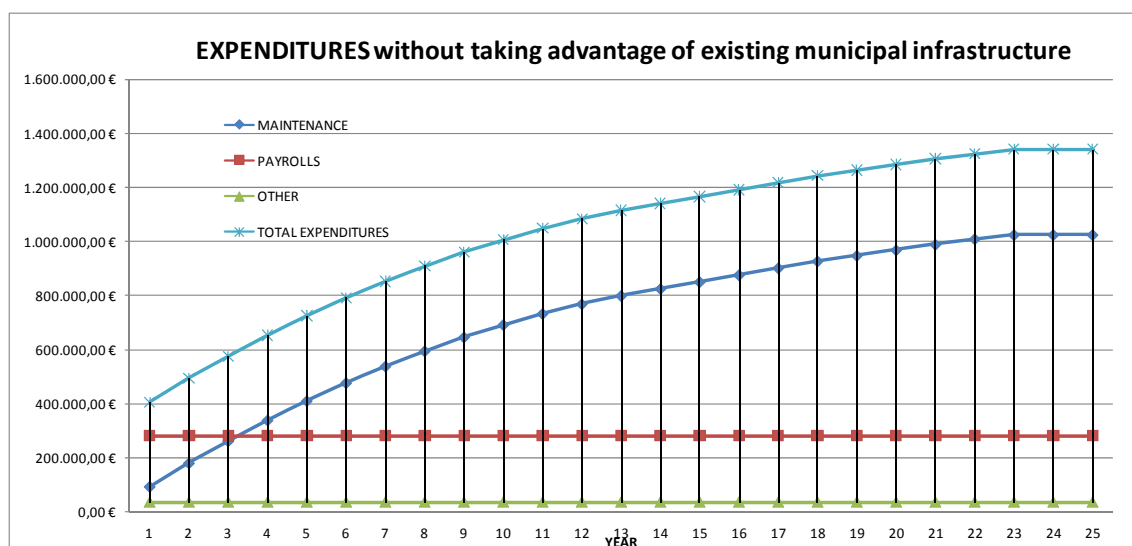


Fig. 33 Expenditures during the 25 years

In Annex I the complete tables of expenditures is presented.

3.6.6. Business Plan Results

The Net Present Value (NPV) is a procedure used to calculate the present value of a number of future cash flows resulting from an investment. The methodology consists of discounting to the present (i.e., updated by a rate) all future cash flows of the project. This value is subtracted from the initial investment, so that the value obtained is the net present value of the project.

The formula to calculate the net present value is the next:

$$NPV = \sum_{t=1}^n \frac{V_t}{(1+k)^t} - I_0 \quad (3.2)$$

Where:

- V_t is the result of the cash flows in year “t”.
- I_0 is the value of the initial investment.
- n is the number of periods considered.
- k is the interest applicable, because it must take into account inflation, because a euro today will have a different value in a few years, is calculated as follows:

$$K = \left(\frac{1 + Rate}{1 + CPI} \right) - 1 \quad (3.3)$$

In the project an interest rate of 7% and Consumer Price Index (CPI) of 2,8% is considered. The CPI value has been set taking into account the average CPI for the last 10 years.

When the NPV takes a value equal to 0, k becomes the Internal Rate Return (IRR). In other words, the IRR is defined as the interest rate when the NPV equals zero.

The IRR indicates the profitability of the project. And the NPV indicates if a project can generate more money than the money investors receive from other projects with the same rate of return. If the NPV is greater than 0, this means that the project is attractive for the given rate of return. If it is equal to 0, it means that it generates the same return. If the NPV is negative, is not recommended to invest in that project. The NPV is computed for a specific number of years, considering a longer or shorter period of time will give different results.

The NPV may also provide other important data, such as the time to recover the investment. So it gives to the investor the number of years that should hold his money invested in a project before obtaining a positive NPV.

The following table shows the NPV and IRR of the estimates for the different models:

Table 36. NPV and IRR project a period of 25 years

	Optimistic model	Intermediate Model	Pessimistic model
NPV	112.254.645 €	80.316.678 €	50.048.663 €
IRR	54,00%	34,79%	21,79%

In business plans a concept called breakeven point (BEP) exists, which is the point at which cost or expenses and revenue are equal: there is no net loss or gain.

The figure below shows the BEP, for the optimistic model. It shows that in year 3 it starts making profits, and the investment is recovered in 5 years.

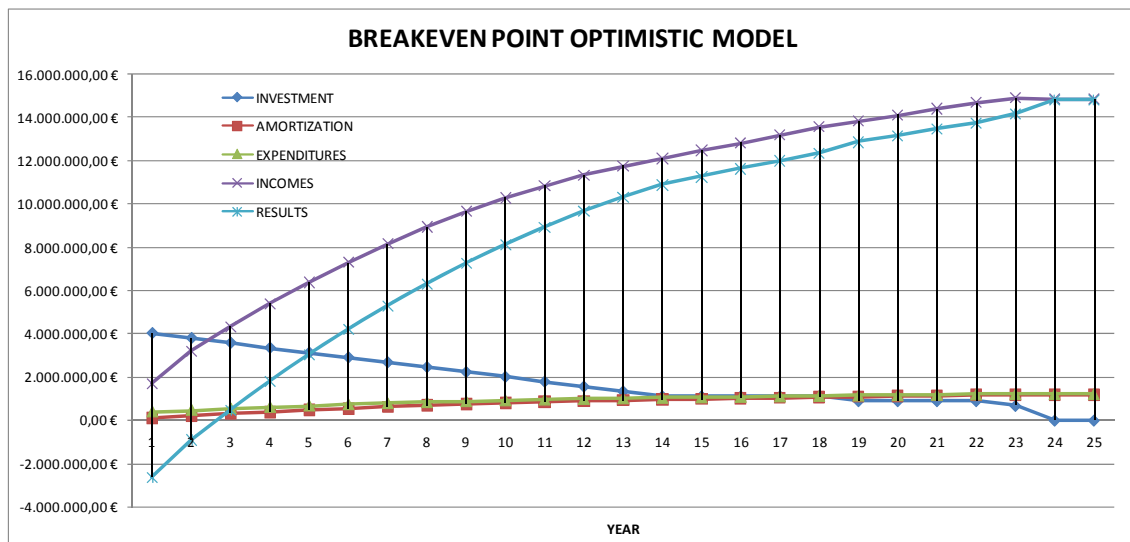


Fig. 34 Breakeven point optimistic model

The next figure shows the BEP, for the intermediate model. It shows that in year 4 the project starts making profits, and investment is recovered in 6,5 years.

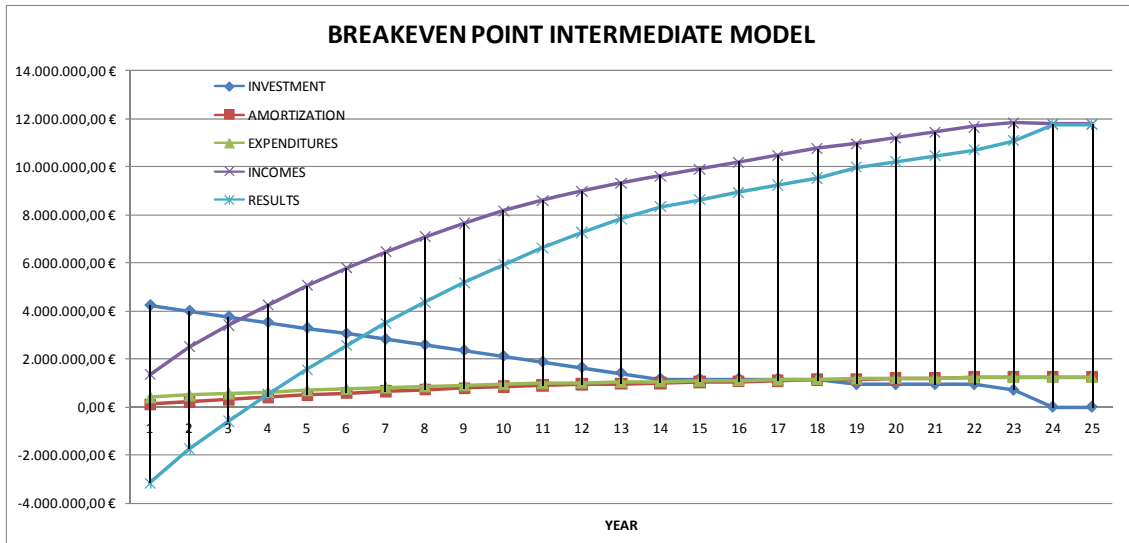


Fig. 35 Breakeven point intermediate model

The next figure shows the BEP, for the intermediate model. It shows that in year 5 the project starts making profits, and investment is recovered in 8 years.

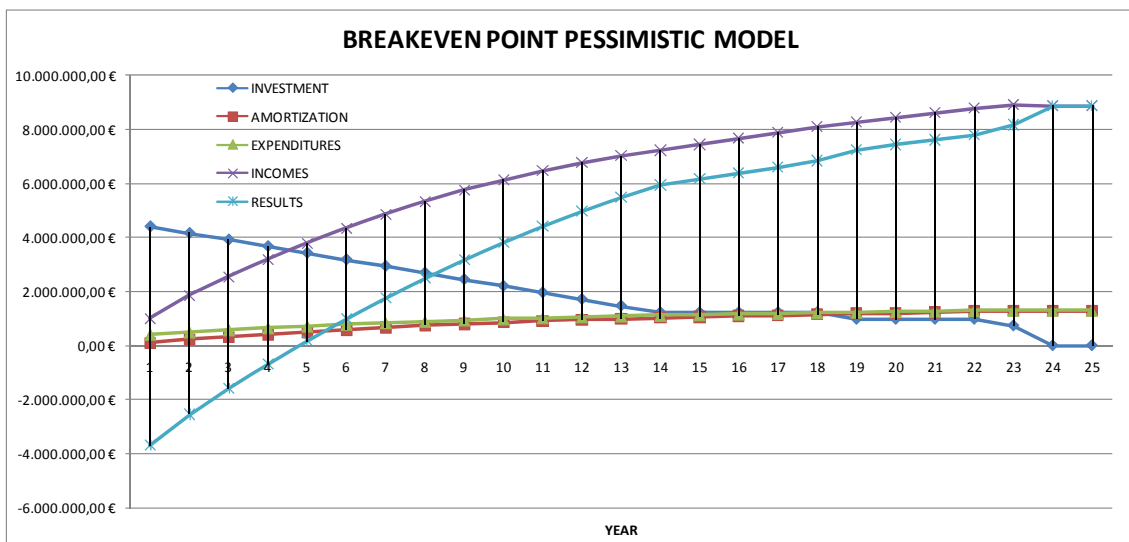


Fig. 36 Breakeven point pessimistic model

The figure below shows the results of the business plan to 25 years for each model.

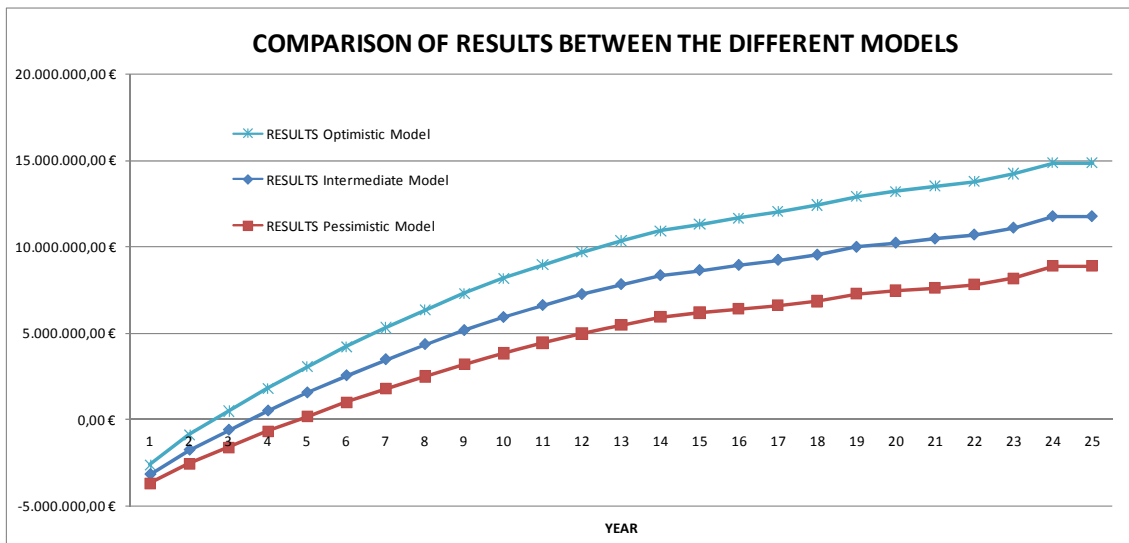


Fig. 37 Comparison RESULTS of business plan

The following figure shows the accumulated result of business plan to 25 years for the different models used.

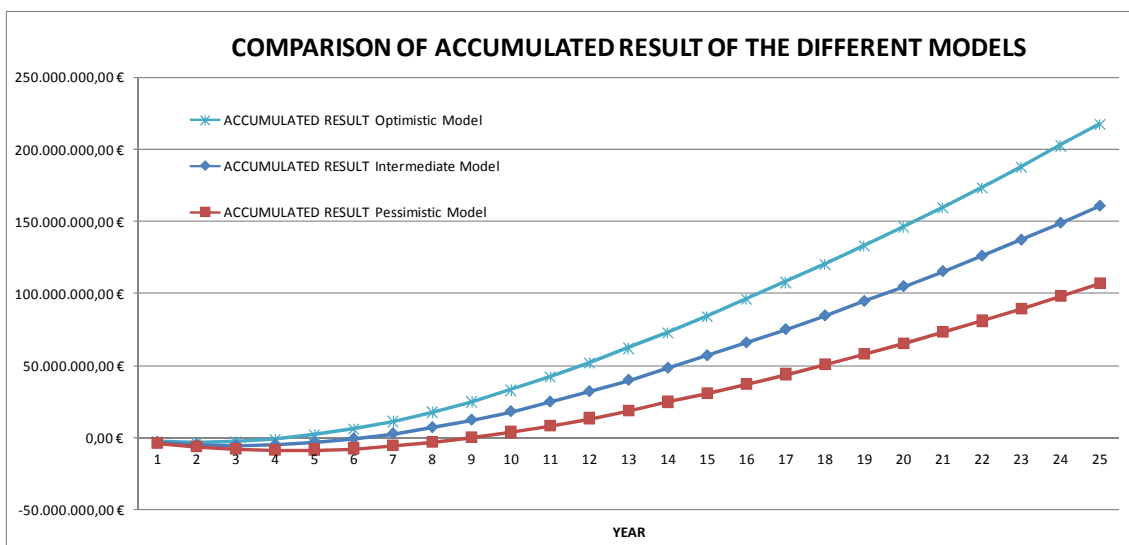


Fig. 38 Comparison of ACCUMULATED RESULT of business plan

In Annex I the detailed business plan is included.

CONCLUSIONS

In this section the main conclusions of this thesis are presented.

Currently, in the city of Barcelona telecommunication operators offer high speed connections to those who can pay a high cost for these connections, which are mostly big and medium enterprises. Small enterprises and residential users can not have these infrastructures of high speeds, because they can not pay the costs or because optical fibre is not available, and they are still using the old copper wire.

The connectivity needs of the city are increasing, as is the volume of information that the city should manage. The city of Barcelona is facing an environment conditioned by a greater number of smart devices in the street (Smart City). A significant part of these devices are linked to the intelligent city and require connectivity.

These needs will increase the communications requirements of the city on the short, medium and long-term. If it were not so, the needs should be covered with the connectivity contracted in the private sector with increased public expenditure.

The City Council, in its self-service provision, has a fibre optic network to cover these needs. And in a part of the city, particularly in the 22@ technology district, it acts as an operator of dark fibre.

In Barcelona city there are many infrastructures that can potentially be used to provide telecommunications services. Examples are fibres, ducts, galleries, sewer pipes and vacuum systems for waste where excess capacity can be provided to be used by telecommunication services.

These municipal infrastructures mean that each of the infrastructures have been managed vertically. Therefore, these are managed by each of the entities with different criteria and models. This implies that for any action on the city needs to establish relationships with multiple spokespersons. Some of these infrastructures are not documented, and therefore the existence is unknown by those potential users.

These infrastructure surpluses can be made available to the city itself and the operators, by a neutral dark fibre operator. This would create benefits for citizens and operators and solve the deficient networks.

The state regulatory framework makes clear that a Public Administration that wants to exploit public networks or electronic communications services available to the public, must act in accordance with the principle investor in a market economy.

The neutral dark fibre network that it is proposed in this project, gives solution to all topologies and technologies of next generation networks, because the

technology of each operator is a distinguishing feature when they compete between them. Therefore, it will have to respond to different operators and therefore have any technology as FTTCab, FTTC, FTTB and FTTH. Topologies, P2P and P2MP models. Active and passive architectures.

The Barcelona town plan, for a big part, is formed by a uniform grid of blocks. Therefore, these representative city blocks have been used as reference to calculate the demand of the city. The result has been an average per city block of 345 homes, 30 business premises and 25 industrial premises, resulting in a total of 400 commercial units per city block.

The network that is proposed in this project consists of three typical segments of a telecommunications network. The Feeder network segment that it would connect the Hub/Headend of the city, such as the Carrierhouse or Catnix, to the Convergence Points (LCP) rooms. The second segment network is the Distribution segment, which would connect the LCP rooms to Network Access Point (NAP) rooms. The third segment network is called Drop, which would connect the NAPs to the Optical Network Terminal (ONT), which is the end-user's connection to the network.

The value chain of a telecom operator is divided into three levels, the passive infrastructure, connectivity service or active infrastructure and final service. The services offered by the operator are focused only in the passive level, i.e. only in the marketing of passive elements, such as fibre optics.

The infrastructure of the neutral operator is aimed at the entire market of electronic communications operators. However, four major types of needs are detected; the Xarxa Oberta of the Catalan Government, connecting the locations of the mobile network, the Next Generation Network of fibre to the home / business, and the connectivity to the city.

The operator will market its services in different sectors, residential, business (basic and premium) and the P2P mode. These modalities have different pricing schemes and SLAs.

A business plan is created for the neutral dark fibre operator over a time span of 25 years. This plan includes the deployment plan, the investment to be made, source of incomes, amortization and expenditures.

Investments are differentiated in three concepts: electromechanical installation, civil works and the adequacy of the technical rooms. These investments represent respectively 27,64%, 68,34% and 4,02% of the total investment.

An inventory to quantify the existing municipal infrastructure, that could be used by the neutral operator is not available. Because of this reason, in this project three models of estimation (optimistic, intermediate and pessimistic) have been implanted. For each model a different use percentage is applied.

Incomes have been differentiated in three types of customers: residential, business and P2P connections. For residential and business, the penetration of

connections in homes that it is done with three estimated scenarios: optimistic, intermediate and pessimistic. There is assumed that they will be 80%, 65% and 50%, respectively. The same approach has been made for the P2P connections, but with different percentages depending on their customers.

The expenditures section has included all costs attributable to preventive and corrective maintenance of the network, staff, rental of premises and other expenses. The cost of maintaining the network is considered as 2% of the investment.

As a result of the business plan, in the pessimistic model the operator starts making profits in year 5, and the investment is recovered in 8 years. In the intermediate model the operator starts making profits in year 4 and the investment is recovered in 6,5 years. In the optimistic model the operator starts making profits in year 3 and the investment is recovered in 5 years. With these results it is concluded that the business plan is viable.

As a final conclusion, commenting that the creation of this neutral operator would represent for the city, to minimize the proceedings in the street, participating from City Council in the operation of ducts, ensure coverage in the area, rationalize the use of ducts, build a new network of municipal services and an urban dark fibre market, all in acting in accordance with the principle of private investor.

REFERENCES

- [1] Green, P.E., "Fibre to the Home. The new empowerment", John Wiley & Sons, 2006.
- [2] Aula Barcelona, "El districte d'activitats 22@bcn", Antoni Oliva, 2004.
- [3] Comisión del Mercado de las Telecomunicaciones, Consulta Pública sobre Redes de Acceso de Nueva Generación, Consulta NGaNS, May 10th 2007.
- [4] Comisión del Mercado de las Telecomunicaciones, Report on the penetration of telecommunications services and infrastructure by province and autonomous community, 2008.
<www.cmt.es/cmt_ptl_ext/SelectOption.do?nav=publi_estudios&detalles=0900271980083c1f&pagina=1>
- [5] European Commission, Community Guidelines for the application of State aid rules in relation to rapid deployment of Broadband Networks, European Commission, September 2009 < ec.europa.eu >
- [6] Normativa Pla Especial Infraestructures del Poblenou. Ajuntament de Barcelona, 2000.
- [7] R. B. Batson, "FTTH Content Business Case Study and the FTTH Industry in Korea", WSN TV 75, 2004.
- [8] PTS, "Dark fibre - market and state of competition", Jenny Bohman and Thorbjörn Blomdahl, 2008.
- [9] Àrea Metropolitana de Barcelona, "La formació de la urbanística metropolitana de Barcelona", Manuel de Torres i Capell, 1999.

Conferences attended:

- Jornades de la Generalitat de Catalunya. El planejament de les telecomunicacions en l'ordenació territorial i urbanística, Barcelona, July 12th, 2010.
- Diada de les telecomunicacions de Catalunya, 3a taula, Fibra òptica, realitat o il·lusió, COETTC, setember 21th, 2010.
- TIC.Cat, Les Xarxes de Nova Generació com a eines per impulsar un nou model productiu a Catalunya, Barcelona, October 13th, 2010.
- FTTH Forum, Barcelona, May 5-8th, 2009, www.ftthforum.net
- IDATE DigiWorld Summit, Montpellier, November 18th-19th, 2009.
- FTTH Council Europe conference, Paris, February 27th-28th, 2008.

DEFINITIONS AND ABBREVIATIONS USED

Access network: That part of the electronic communications network closest to the end user which runs from the end user's network termination point to a point where the traffic is transferred to a network with higher capacity that is intended to transmit large volumes of traffic.

Access technology: The technology used in the part of the electronic communications network that is closest to the end user.

ADSL: Asymmetric Digital Subscriber Line

Backbone network: A network that links national nodes and main nodes in the various parts of the country.

CAPEX: Capital Expenditures

CMT: Comisión del Mercado de las Telecomunicaciones

Dark fibre: This dark fibre service, which is produced using optical fibre and is provided as a wholesale service or retail service. Dark fibre is a cable that is not lit up; i.e., physical fibre cables without electronic equipment.

Demand density: Measure of how the potential demand for a service is concentrated or dispersed in the different geographical segments of a market.

Distribution network: The network that links the Local Convergence Points and the Network Access Points in the various parts of the city.

Drop network: The network that links the Network Access Points and the Optical Network Terminal in the various parts of the city.

Ducting: Pipes for rolling out optical fibre cables and manholes in which the fibre links are placed.

Ethernet: a family of technologies for communication in local area networks.

Feeder network: The network that links the Hubs/Headends and the Local Convergence Point in the various parts of the city.

FTTB: Fibre to the Base

FTTC: Fibre to the Curb

FTTCAB: Fibre to the Cabinet

FTTH: Fibre to the Home

Hub/Headend: Major telecommunications nodes in the city where there is a large concentration of telecom operators.

Joint laying: When ducting is utilised for several purpose, e.g., electronic communications services, power, water and sewerage.

LCP: Local Convergence Point room.

Local fibre network: A network based on optical fibre, which belongs to an operator that is active within a limited geographical area, such as a community or a region, and which does not provide services at a national level.

Marginal cost: Economic term; expressed simply, a marginal cost is the increase in the total costs that occurs when one (1) additional unit of a product is produced.

Municipal network: A municipal network is comparable with one or more continuous local area networks. A local area network is found within one area, such as a housing or industrial area within a community. Models for municipal networks vary.

NAP: Network Access Point room.

NGA: Next Generation Access

NGAN Next Generation Access Networks

NGN: Next Generation Network

NPV: Net Present Value

OAM: Operation Administration and Maintenance

OLT: one optical line terminal

ONT: Optical Network Terminal

ONU: optical network units

OPEX: Operational Expenditures

Optical fibre: Fibre-based infrastructure. Optical fibre is a thin glass line made from silicon dioxide (glass) that transfers data via light instead of via electronic signals as is the case in a copper line.

P2MP: Point to Multipoint

P2P: Point to Point

Passive infrastructure: Active and passive infrastructure are referred to in the chain of refinement in terms of optical fibre. Passive infrastructure is, for example, ducting, such as pipework for cables in addition to non-active cables such as dark fibre.

PON: Passive Optical Network

ANNEX I. Detailed business plan

A) Business plan optimistic model

ANNEX I. A SUMMARY OF BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - OPTIMISTIC MODEL TO 25 YEARS (CONSTANT EUROS)													NEUTRAL OPERATOR	
BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)														
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works	15,00%	30.637.532,39	22.391.960,57	2.757.377,92	2.604.190,25	2.451.002,59	2.297.814,93	2.144.627,27	1.378.688,96	765.938,31	612.750,65	0,00	30.637.532,39
2	Fibre	7,50%	12.393.527,57	9.058.019,98	1.115.417,48	1.053.449,84	991.482,21	929.514,57	867.546,93	557.708,74	309.838,19	247.870,55	0,00	12.393.527,57
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	81.000,00	45.000,00	36.000,00	0,00	1.800.000,00
Total			44.831.059,96	32.765.541,11	4.034.795,40	3.810.640,10	3.586.484,80	3.362.329,50	3.138.174,20	2.017.397,70	1.120.776,50	896.621,20	0,00	44.831.059,96
AMORTIZATION		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works		10.701.690,06	5.897.848,53	55.147,56	107.231,36	156.251,42	202.207,71	245.100,26	413.606,69	508.583,04	579.049,36	612.750,65	10.701.690,06
2	Fibre		8.658.118,36	4.771.608,07	44.616,70	86.754,69	126.413,98	163.594,56	198.296,44	334.625,24	411.465,12	468.475,34	495.741,10	8.658.118,36
3	Adaptation of the rooms		1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	48.600,00	59.760,00	68.040,00	72.000,00	1.257.480,00
Total			19.359.808,42	11.362.471,11	106.244,26	206.586,06	301.025,40	389.562,28	472.196,70	796.831,93	979.808,15	1.115.564,70	1.180.491,75	20.617.288,42
EXPENDITURES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Maintenance		15.659.489,24	8.630.159,82	80.695,91	156.908,71	228.638,41	295.885,00	358.648,48	605.219,31	744.195,60	847.307,03	896.621,20	15.659.489,24
2	Payrolls		7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00
3	Other		875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00
Total			23.534.489,24	13.506.890,87	395.695,91	471.908,71	543.638,41	610.885,00	673.648,48	920.219,31	1.059.195,60	1.162.307,03	1.211.621,20	23.534.489,24
INCOMES			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
1	FIBRE RENT INCOMES		144.656.870,99	1.390.231,54	2.875.894,67	4.036.989,37	5.125.515,66	6.141.473,52	10.132.736,57	12.382.357,56	14.051.431,20	14.849.683,81		
2	FIBRE REGISTRATION INCOMES		2.507.735,31	311.289,37	303.436,07	272.619,26	255.580,56	238.541,86	153.348,34	85.193,52	68.154,82	0,00		
TOTAL			147.164.606,31	1.701.520,92	3.179.330,73	4.309.608,64	5.381.096,22	6.380.015,38	10.286.084,91	12.467.551,08	14.119.586,02	14.849.683,81		
RESULTS			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
RESULT		217.307.338,58	112.254.645,44	-2.622.726,13	-896.632,01	480.510,83	1.797.444,00	3.040.389,40	8.145.299,83	11.267.387,14	13.176.222,49	14.818.554,36		
IRR		54,00%		-2.622.726,13	-3.519.358,15	-3.038.847,32	-1.241.403,31	1.798.986,09	33.055.542,11	84.154.438,57	146.232.727,04	217.307.338,58		
SCENARIO DATA														
Rate		7,00%												
CPI		2,80%												
Real		4,09%												

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

Table AI2a. Investment of civil works Optimistic Model

ANNEX I. A- INVESTMENT OF CIVIL WORKS					NEUTRAL
Business plan OPTIMISTIC MODEL					OPERATOR
TOTAL INVESTMENT OF CIVIL WORKS PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Duct on the footpath (1 tube)	m	240,00	59,05 €	14.172,00 €
1.02	Ducts on the footpath (2 tubes)	m	488,00	74,28 €	36.248,64 €
1.03	Ducts on the road (2 tubes)	m	40,00	124,75 €	4.990,00 €
1.04	Manhole	Ut	12,00	785,72 €	9.428,64 €
3.01	Subtotal				64.839,28 €
1.05	Safety and Health	pa	2,5%		1.620,98 €
3.02	Total Budget Material Execution				66.460,26 €
1.06	General Expenses		13,0%		8.639,83 €
1.07	Industrial Profit		6,0%		3.987,62 €
3.03	Subtotal				79.087,71 €
1.08	Quality Control	pa	2,0%		1.296,79 €
1.09	Services Affected	pa	7,0%		4.538,75 €
1.10	Project Management	pa	8,0%		5.187,14 €
5.01	TOTAL BUDGET PER CITY BLOCK (without applying 7.01)				90.110,39 €
7.01	Use percentage of existing civil works infrastructure			15,0%	13.516,56 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				76.593,83 €

Table AI3a. Investment of fibre Optimistic Model

ANNEX I. A- INVESTMENT OF FIBRE Business plan OPTIMISTIC MODEL					NEUTRAL OPERATOR
TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Fibre Splices	Ut	220,00	15,54 €	3.418,80 €
1.02	Fibre optic cable up to 24 FO	m	65,00	6,81 €	442,65 €
1.03	Fibre optic cable up to 48 FO	m	65,00	7,32 €	475,80 €
1.04	Fibre optic cable up to 144 FO	m	130,00	12,61 €	1.639,30 €
1.05	Fibre optic cable up to 288 FO	m	720,00	17,92 €	12.902,40 €
1.05	Tube of polyethylene 40 mm	m	3.888,00	1,26 €	4.898,88 €
1.06	Splices Box	Ut	4,00	374,00 €	1.496,00 €
1.07	Distribution Racks	Ut	0,25	427,00 €	106,75 €
3.01	Subtotal				25.380,58 €
1.08	Safety and Health	pa	2,5%		634,51 €
3.02	Total Budget Material Execution				26.015,09 €
1.09	General Expenses		13,0%		3.381,96 €
1.10	Industrial Profit		6,0%		1.560,91 €
3.03	Subtotal				30.957,96 €
1.11	Quality Control	pa	2,0%		507,61 €
1.12	Project Management	pa	8,0%		2.030,45 €
5.01	TOTAL BUDGET PER CITY BLOCK				33.496,02 €
7.01	Us percentage of existing fibre infrastructure			7,5%	2.512,20 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				30.983,82 €
Note:	Concepts 1.01, 1.02, 1.03, 1.04, 1.05, 1.06 and 1.07 include supply and installation				

Table AI4a. Total Investment Optimistic Model

ANNEX I. A - TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION AND CIVIL WORKS													
Business plan OPTIMISTIC MODEL													
(CONSTANT EUROS)													
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
1 Civil Works	15,00%	2.757.377,92	2.604.190,25	2.451.002,59	2.297.814,93	2.144.627,27	1.991.439,61	1.838.251,94	1.685.064,28	1.531.876,62	1.378.688,96	1.225.501,30	1.072.313,63
2 Fibre	7,50%	1.115.417,48	1.053.449,84	991.482,21	929.514,57	867.546,93	805.579,29	743.611,65	681.644,02	619.676,38	557.708,74	495.741,10	433.773,46
3 Adaptation of the rooms		162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00
Total		4.034.795,40	3.810.640,10	3.586.484,80	3.362.329,50	3.138.174,20	2.914.018,90	2.689.863,60	2.465.708,30	2.241.553,00	2.017.397,70	1.793.242,40	1.569.087,10
Total Accumulated		4.034.795,40	7.845.435,49	11.431.920,29	14.794.249,79	17.932.423,98	20.846.442,88	23.536.306,48	26.002.014,78	28.243.567,77	30.260.965,47	32.054.207,87	33.623.294,97
COVERED BLOCKS		36	34	32	30	28	26	24	22	20	18	16	14
ACCUMULATED NUMBER OF COVERED BLOCKS		36	70	102	132	160	186	210	232	252	270	286	300
(%) Covered blocks of the total		9,00%	17,50%	25,50%	33,00%	40,00%	46,50%	52,50%	58,00%	63,00%	67,50%	71,50%	75,00%

NEUTRAL OPERATOR

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
919.125,97	765.938,31	765.938,31	765.938,31	765.938,31	765.938,31	612.750,65	612.750,65	612.750,65	612.750,65	459.562,99	0,00	0,00	30.637.532,39
371.805,83	309.838,19	309.838,19	309.838,19	309.838,19	309.838,19	247.870,55	247.870,55	247.870,55	247.870,55	185.902,91	0,00	0,00	12.393.527,57
54.000,00	45.000,00	45.000,00	45.000,00	45.000,00	45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00
1.344.931,80	1.120.776,50	1.120.776,50	1.120.776,50	1.120.776,50	1.120.776,50	896.621,20	896.621,20	896.621,20	896.621,20	672.465,90	0,00	0,00	43.031.059,96
34.968.226,77	36.089.003,27	37.209.779,76	38.330.556,26	39.451.332,76	40.572.109,26	41.468.730,46	42.365.351,66	43.261.972,86	44.158.594,06	44.831.059,96	44.831.059,96	44.831.059,96	
12	10	10	10	10	10	8	8	8	8	6	0	0	
312	322	332	342	352	362	370	378	386	394	400	400	400	
78,00%	80,50%	83,00%	85,50%	88,00%	90,50%	92,50%	94,50%	96,50%	98,50%	100,00%	100,00%	100,00%	

Table AI5a. Expenditures Optimistic Model

ANNEX I. A - EXPENDITURES													
Business plan OPTIMISTIC MODEL													
EXPENDITURES													
(Constant EUROS)	CAPEX INVESTMENT 2,00%	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	
MAINTENANCE		80.696	156.909	228.638	295.885	358.648	416.929	470.726	520.040	564.871	605.219	641.084	
PAYROLLS		280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	
OTHER		35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	
TOTAL EXPENDITURES		395.696	471.909	543.638	610.885	673.648	731.929	785.726	835.040	879.871	920.219	956.084	
												NEUTRAL OPERATOR	
YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
672.466	699.365	721.780	744.196	766.611	789.027	811.442	829.375	847.307	865.239	883.172	896.621	896.621	896.621
280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000
35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000
987.466	1.014.365	1.036.780	1.059.196	1.081.611	1.104.027	1.126.442	1.144.375	1.162.307	1.180.239	1.198.172	1.211.621	1.211.621	1.211.621

Table AI6a. Icomes Optimistic Model

ANNEX I. A - INCOMES

Business plan OPTIMISTIC MODEL

TOTAL INCOMES (CONSTANT EUROS)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
RESIDENTIAL RENT INCOMES	473.381,62	920.464,27	1.341.247,93	1.735.732,62	2.103.918,32	2.445.805,05	2.761.392,80	3.050.681,57	3.313.671,36	3.550.362,17	3.760.754,01	3.944.846,86
RESIDENTIAL REGISTRATION INCOMES	246.979,15	233.258,09	219.537,02	205.815,96	192.094,90	178.373,83	164.652,77	150.931,70	137.210,64	123.489,58	109.768,51	96.047,45
TOTAL RESIDENTIAL INCOMES	720.360,78	1.153.722,35	1.560.784,96	1.941.548,58	2.296.013,22	2.624.178,88	2.926.045,57	3.201.613,27	3.450.882,00	3.673.851,75	3.870.522,52	4.040.894,31
BUSINESS RENT INCOMES	688.849,92	1.339.430,40	1.951.741,44	2.525.783,04	3.061.555,20	3.559.057,92	4.018.291,20	4.439.255,04	4.821.949,44	5.166.374,40	5.472.529,92	5.740.416,00
BUSINESS REGISTRATION INCOMES	51.844,32	48.964,08	46.083,84	43.203,60	40.323,36	37.443,12	34.562,88	31.682,64	28.802,40	25.922,16	23.041,92	20.161,68
TOTAL BUSINESS INCOMES	740.694,24	1.388.394,48	1.997.825,28	2.568.986,64	3.101.878,56	3.596.501,04	4.052.854,08	4.470.937,68	4.850.751,84	5.192.296,56	5.495.571,84	5.760.577,68
P2P (Mobiles and other) RENT INCOMES	144.000,00	280.000,00	408.000,00	528.000,00	640.000,00	744.000,00	840.000,00	928.000,00	1.008.000,00	1.080.000,00	1.144.000,00	1.200.000,00
P2P (Mobiles and other) REGISTRATION INCOMES	7.873,20	7.435,80	6.998,40	6.561,00	6.123,60	5.686,20	5.248,80	4.811,40	4.374,00	3.936,60	3.499,20	3.061,80
P2P (Xarxa Oberta) RENT INCOMES	84.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00
P2P (Xarxa Oberta) REGISTRATION INCOMES	4.592,70	13.778,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL P2P INCOMES	240.465,90	637.213,90	750.998,40	870.561,00	982.123,60	1.085.686,20	1.181.248,80	1.268.811,40	1.348.374,00	1.419.936,60	1.483.499,20	1.539.061,80
COVERED BLOCKS	36	34	32	30	28	26	24	22	20	18	16	14
ACCUMULATED NUMBER OF COVERED BLOCKS	36	70	102	132	160	186	210	232	252	270	286	300
TOTAL INCOMES	1.701.520,92	3.179.330,73	4.309.608,64	5.381.096,22	6.380.015,38	7.306.366,12	8.160.148,45	8.941.362,35	9.650.007,84	10.286.084,91	10.849.593,56	11.340.533,79

NEUTRAL
OPERATOR

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
4.102.640,73	4.234.135,63	4.365.630,52	4.497.125,42	4.628.620,31	4.760.115,21	4.865.311,13	4.970.507,04	5.075.702,96	5.180.898,87	5.259.795,81	5.259.795,81	5.259.795,81
82.326,38	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32	68.605,32
4.184.967,12	4.302.740,95	4.434.235,84	4.565.730,74	4.697.225,63	4.828.720,53	4.920.195,38	5.025.391,30	5.130.587,21	5.235.783,13	5.300.959,00	5.259.795,81	5.259.795,81
5.970.032,64	6.161.379,84	6.352.727,04	6.544.074,24	6.735.421,44	6.926.768,64	7.079.846,40	7.232.924,16	7.386.001,92	7.539.079,68	7.653.888,00	7.653.888,00	7.653.888,00
17.281,44	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20	14.401,20
5.987.314,08	6.175.781,04	6.367.128,24	6.558.475,44	6.749.822,64	6.941.169,84	7.091.367,36	7.244.445,12	7.397.522,88	7.550.600,64	7.662.528,72	7.653.888,00	7.653.888,00
1.248.000,00	1.288.000,00	1.328.000,00	1.368.000,00	1.408.000,00	1.448.000,00	1.480.000,00	1.512.000,00	1.544.000,00	1.576.000,00	1.600.000,00	1.600.000,00	1.600.000,00
2.624,40	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00	2.187,00
336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00	336.000,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1.586.624,40	1.626.187,00	1.666.187,00	1.706.187,00	1.746.187,00	1.786.187,00	1.817.749,60	1.849.749,60	1.881.749,60	1.913.749,60	1.937.312,20	1.936.000,00	1.936.000,00
12	10	10	10	10	10	8	8	8	8	6	0	0
312	322	332	342	352	362	370	378	386	394	400	400	400
11.758.905,60	12.104.708,99	12.467.551,08	12.830.393,18	13.193.235,27	13.556.077,37	13.829.312,34	14.119.586,02	14.409.859,69	14.700.133,37	14.900.799,92	14.849.683,81	14.849.683,81

Table AI8a. Business plan Optimistic Model

ANNEX I. A BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - OPTIMISTIC MODEL TO 25 YEARS (CONSTANT EUROS)																					
BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)																					
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Civil Works	15,00%	30.637.532,39	22.391.960,57	2.757.377,92	2.604.190,25	2.451.002,59	2.297.814,93	2.144.627,27	1.991.439,61	1.838.251,94	1.685.064,28	1.531.876,62	1.378.688,96	1.225.501,30	1.072.313,63	919.125,97	765.938,31	765.938,31	765.938,31	765.938,31
2	Fibre	7,50%	12.393.527,57	9.058.019,98	1.115.417,48	1.053.449,84	991.482,21	929.514,57	867.546,93	805.579,29	743.611,65	681.644,02	619.676,38	557.708,74	495.741,10	433.773,46	371.805,83	309.838,19	309.838,19	309.838,19	309.838,19
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00	54.000,00	45.000,00	45.000,00	45.000,00	45.000,00
Total			44.831.059,96	32.765.541,11	4.034.795,40	3.810.640,10	3.586.484,80	3.362.329,50	3.138.174,20	2.914.018,90	2.689.863,60	2.465.708,30	2.241.553,00	2.017.397,70	1.793.242,40	1.569.087,10	1.344.931,80	1.120.776,50	1.120.776,50	1.120.776,50	1.120.776,50
AMORTIZATION		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Civil Works	10.701.690,06	5.897.848,53	55.147,56	107.231,36	156.251,42	202.207,71	245.100,26	284.929,05	321.694,09	355.395,38	386.032,91	413.606,69	438.116,71	459.562,99	477.945,51	493.264,27	508.583,04	523.901,80	539.220,57	
2	Fibre	8.658.118,36	4.771.608,07	44.616,70	86.754,69	126.413,98	163.594,56	198.296,44	230.519,61	260.264,08	287.529,84	312.316,89	334.625,24	354.454,89	371.805,83	386.678,06	399.071,59	411.465,12	423.858,64	436.252,17	
3	Adaptation of the rooms	1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	33.480,00	37.800,00	41.760,00	45.360,00	48.600,00	51.480,00	54.000,00	56.160,00	57.960,00	59.760,00	61.560,00	63.360,00	
Total			19.359.808,42	11.362.471,11	106.244,26	206.586,06	301.025,40	389.562,28	472.196,70	548.928,66	619.758,17	684.685,22	743.709,80	796.831,93	844.051,60	885.368,81	920.783,57	950.295,86	979.808,15	1.009.320,45	1.038.832,74
EXPENDITURES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Maintenance	15.659.489,24	8.630.159,82	80.695,91	156.908,71	228.638,41	295.885,00	358.648,48	416.928,86	470.726,13	520.040,30	564.871,36	605.219,31	641.084,16	672.465,90	699.364,54	721.780,07	744.195,60	766.611,13	789.026,66	
2	Payrolls	7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	
3	Other	875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	
Total			23.534.489,24	13.506.890,87	395.695,91	471.908,71	543.638,41	610.885,00	673.648,48	731.928,86	785.726,13	835.040,30	879.871,36	920.219,31	956.084,16	987.465,90	1.014.364,54	1.036.780,07	1.059.195,60	1.081.611,13	1.104.026,66
INCOMES		NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17		
1	FIBRE RENT INCOMES	144.656.870,99	1.390.231,54	2.875.894,67	4.036.989,37	5.125.515,66	6.141.473,52	7.084.862,97	7.955.684,00	8.753.936,61	9.479.620,80	10.132.736,57	10.713.283,93	11.221.262,86	11.656.673,37	12.019.515,47	12.382.357,56	12.745.199,66	13.108.041,75		
2	FIBRE REGISTRATION INCOMES	2.507.735,31	311.289,37	303.436,07	272.619,26	255.580,56	238.541,86	221.503,15	204.464,45	187.425,74	170.387,04	153.348,34	136.309,63	119.270,93	102.232,22	85.193,52	85.193,52	85.193,52	85.193,52		
TOTAL			147.164.606,31	1.701.520,92	3.179.330,73	4.309.608,64	5.381.096,22	6.380.015,38	7.306.366,12	8.160.148,45	8.941.362,35	9.650.007,84	10.286.084,91	10.849.593,56	11.340.533,79	11.758.905,60	12.104.708,99	12.467.551,08	12.830.393,18	13.193.235,27	
RESULTS		NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17		
RESULT		217.307.338,58	112.254.645,44	-2.622.726,13	-896.632,01	480.510,83	1.797.444,00	3.040.389,40	4.209.347,03	5.304.316,89	6.325.298,98	7.272.293,29	8.145.299,83	8.944.318,60	9.669.349,60	10.320.392,83	10.897.448,28	11.267.387,14	11.637.326,00	12.007.264,86	
IRR		54,00%	-2.622.726,13	-3.519.358,15	-3.038.847,32	-1.241.403,31	1.798.986,09	6.008.333,12	11.312.650,01	17.637.948,99	24.910.242,28	33.055.542,11	41.999.860,72	51.669.210,32	61.989.603,15	72.887.051,43	84.154.438,57	95.791.764,57	107.799.029,43		

NEUTRAL OPERATOR								
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
765.938,31	612.750,65	612.750,65	612.750,65	612.750,65	459.562,99	0,00	0,00	30.637.532,39
309.838,19	247.870,55	247.870,55	247.870,55	247.870,55	185.902,91	0,00	0,00	12.393.527,57
45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00
1.120.776,50	896.621,20	896.621,20	896.621,20	896.621,20	672.465,90	0,00	0,00	44.831.059,96
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
554.539,34	566.794,35	579.049,36	591.304,38	603.559,39	612.750,65	612.750,65	612.750,65	10.701.690,06
448.645,70	458.560,52	468.475,34	478.390,16	488.304,99	495.741,10	495.741,10	495.741,10	8.658.118,36
65.160,00	66.600,00	68.040,00	69.480,00	70.920,00	72.000,00	72.000,00	72.000,00	1.257.480,00
1.068.345,03	1.091.954,87	1.115.564,70	1.139.174,54	1.162.784,37	1.180.491,75	1.180.491,75	1.180.491,75	20.617.288,42
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
811.442,19	829.374,61	847.307,03	865.239,46	883.171,88	896.621,20	896.621,20	896.621,20	15.659.489,24
280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00
35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00
1.126.442,19	1.144.374,61	1.162.307,03	1.180.239,46	1.198.171,88	1.211.621,20	1.211.621,20	1.211.621,20	23.534.489,24
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	
13.470.883,85	13.761.157,53	14.051.431,20	14.341.704,88	14.631.978,55	14.849.683,81	14.849.683,81	14.849.683,81	
85.193,52	68.154,82	68.154,82	68.154,82	68.154,82	51.116,11	0,00	0,00	
13.556.077,37	13.829.312,34	14.119.586,02	14.409.859,69	14.700.133,37	14.900.799,92	14.849.683,81	14.849.683,81	
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	
12.377.203,72	12.880.271,40	13.176.222,49	13.472.173,58	13.768.124,66	14.197.204,58	14.818.554,36	14.818.554,36	
120.176.233,15	133.056.504,55	146.232.727,04	159.704.900,62	173.473.025,28	187.670.229,86	202.488.784,22	217.307.338,58	

SCENARIO DATA	
Rate	7,00%
CPI	2,80%
Real	4,09%

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

B) Business plan intermediate model

ANNEX I. B SUMMARY OF BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - INTERMEDIATE MODEL TO 25 YEARS (CONSTANT EUROS)													NEUTRAL OPERATOR	
BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)														
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works	10,00%	32.439.740,18	23.709.134,72	2.919.576,62	2.757.377,92	2.595.179,21	2.432.980,51	2.270.781,81	1.459.788,31	810.993,50	648.794,80	0,00	32.439.740,18
2	Fibre	5,00%	12.728.487,77	9.302.831,34	1.145.563,90	1.081.921,46	1.018.279,02	954.636,58	890.994,14	572.781,95	318.212,19	254.569,76	0,00	12.728.487,77
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	81.000,00	45.000,00	36.000,00	0,00	1.800.000,00
Total			46.968.227,95	34.327.526,61	4.227.140,52	3.992.299,38	3.757.458,24	3.522.617,10	3.287.775,96	2.113.570,26	1.174.205,70	939.364,56	0,00	46.968.227,95
AMORTIZATION		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works		11.331.201,24	6.244.780,79	58.391,53	113.539,09	165.442,67	214.102,29	259.517,92	437.936,49	538.499,69	613.111,09	648.794,80	11.331.201,24
2	Fibre		8.892.121,56	4.900.570,45	45.822,56	89.099,41	129.830,58	168.016,04	203.655,80	343.669,17	422.585,79	481.136,84	509.139,51	8.892.121,56
3	Adaptation of the rooms		1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	48.600,00	59.760,00	68.040,00	72.000,00	1.257.480,00
Total			20.223.322,80	11.838.365,76	110.694,09	215.238,51	313.633,25	405.878,32	491.973,73	830.205,66	1.020.845,48	1.162.287,93	1.229.934,31	21.480.802,80
EXPENDITURES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Maintenance		16.406.002,02	9.041.573,28	84.542,81	164.388,80	239.537,96	309.990,30	375.745,82	634.071,08	779.672,58	887.699,51	939.364,56	16.406.002,02
2	Payrolls		7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00
3	Other		875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00
Total			24.281.002,02	13.918.304,32	399.542,81	479.388,80	554.537,96	624.990,30	690.745,82	949.071,08	1.094.672,58	1.202.699,51	1.254.364,56	24.281.002,02
INCOMES			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
1	FIBRE RENT INCOMES		114.698.041,36	1.099.353,13	2.260.964,42	3.184.833,86	4.050.961,47	4.859.347,24	8.035.148,47	9.825.145,52	11.153.207,85	11.788.368,10		
2	FIBRE REGISTRATION INCOMES		2.026.102,24	251.270,88	244.054,64	220.435,90	206.658,65	192.881,41	123.995,19	68.886,22	55.108,97	0,00		
TOTAL			116.724.143,60	1.350.624,01	2.505.019,06	3.405.269,76	4.257.620,12	5.052.228,65	8.159.143,66	9.894.031,74	11.208.316,83	11.788.368,10		
RESULTS			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
RESULT		160.512.392,34	80.316.678,42	-3.165.365,23	-1.751.430,61	-593.093,19	515.891,05	1.565.680,59	5.926.707,98	8.645.998,94	10.228.540,69	11.763.937,85		
IRR		34,79%		-3.165.365,23	-4.916.795,84	-5.509.889,03	-4.993.997,98	-3.428.317,38	18.075.114,65	56.782.212,73	104.716.352,83	160.512.392,34		
SCENARIO DATA														
Rate		7,00%												
CPI		2,80%												
Real		4,09%												

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

Table AI2b. Investment of civil works Intermediate Model

ANNEX I. B- INVESTMENT OF CIVIL WORKS					NEUTRAL
Business plan INTERMEDIATE MODEL					OPERATOR
TOTAL INVESTMENT OF CIVIL WORKS PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Duct on the footpath (1 tube)	m	240,00	59,05 €	14.172,00 €
1.02	Ducts on the footpath (2 tubes)	m	488,00	74,28 €	36.248,64 €
1.03	Ducts on the road (2 tubes)	m	40,00	124,75 €	4.990,00 €
1.04	Manhole	Ut	12,00	785,72 €	9.428,64 €
3.01	Subtotal				64.839,28 €
1.05	Safety and Health	pa	2,5%		1.620,98 €
3.02	Total Budget Material Execution				66.460,26 €
1.06	General Expenses		13,0%		8.639,83 €
1.07	Industrial Profit		6,0%		3.987,62 €
3.03	Subtotal				79.087,71 €
1.08	Quality Control	pa	2,0%		1.296,79 €
1.09	Services Affected	pa	7,0%		4.538,75 €
1.10	Project Management	pa	8,0%		5.187,14 €
5.01	TOTAL BUDGET PER CITY BLOCK (without applying 7.01)				90.110,39 €
7.01	Use percentage of existing civil works infrastructure			10,0%	9.011,04 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				81.099,35 €

Table AI3b. Investment of fibre Intermediate Model

ANNEX I. B- INVESTMENT OF FIBRE Business plan INTERMEDIATE MODEL					NEUTRAL OPERATOR
TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Fibre Splices	Ut	220,00	15,54 €	3.418,80 €
1.02	Fibre optic cable up to 24 FO	m	65,00	6,81 €	442,65 €
1.03	Fibre optic cable up to 48 FO	m	65,00	7,32 €	475,80 €
1.04	Fibre optic cable up to 144 FO	m	130,00	12,61 €	1.639,30 €
1.05	Fibre optic cable up to 288 FO	m	720,00	17,92 €	12.902,40 €
1.05	Tube of polyethylene 40 mm	m	3.888,00	1,26 €	4.898,88 €
1.06	Splices Box	Ut	4,00	374,00 €	1.496,00 €
1.07	Distribution Racks	Ut	0,25	427,00 €	106,75 €
3.01	Subtotal				25.380,58 €
1.08	Safety and Health	pa	2,5%		634,51 €
3.02	Total Budget Material Execution				26.015,09 €
1.09	General Expenses		13,0%		3.381,96 €
1.10	Industrial Profit		6,0%		1.560,91 €
3.03	Subtotal				30.957,96 €
1.11	Quality Control	pa	2,0%		507,61 €
1.12	Project Management	pa	8,0%		2.030,45 €
5.01	TOTAL BUDGET PER CITY BLOCK				33.496,02 €
7.01	Us percentage of existing fibre infraestructure			5,0%	1.674,80 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				31.821,22 €

Note: Concepts 1.01, 1.02, 1.03, 1.04, 1.05, 1.06 and 1.07 include supply and installation

Table AI4b. Total Investment Intermediate Model
ANNEX I. B - TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION AND CIVIL WORKS
Business plan INTERMEDIATE MODEL

(CONSTANT EUROS)

INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
1 Civil Works	10,00%	2.919.576,62	2.757.377,92	2.595.179,21	2.432.980,51	2.270.781,81	2.108.583,11	1.946.384,41	1.784.185,71	1.621.987,01	1.459.788,31	1.297.589,61	1.135.390,91
2 Fibre	5,00%	1.145.563,90	1.081.921,46	1.018.279,02	954.636,58	890.994,14	827.351,71	763.709,27	700.066,83	636.424,39	572.781,95	509.139,51	445.497,07
3 Adaptation of the rooms		162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00
Total		4.227.140,52	3.992.299,38	3.757.458,24	3.522.617,10	3.287.775,96	3.052.934,82	2.818.093,68	2.583.252,54	2.348.411,40	2.113.570,26	1.878.729,12	1.643.887,98
Total Accumulated		4.227.140,52	8.219.439,89	11.976.898,13	15.499.515,22	18.787.291,18	21.840.226,00	24.658.319,67	27.241.572,21	29.589.983,61	31.703.553,87	33.582.282,98	35.226.170,96
COVERED BLOCKS		36	34	32	30	28	26	24	22	20	18	16	14
ACCUMULATED NUMBER OF COVERED BLOCKS		36	70	102	132	160	186	210	232	252	270	286	300
(%) Covered blocks of the total		9,00%	17,50%	25,50%	33,00%	40,00%	46,50%	52,50%	58,00%	63,00%	67,50%	71,50%	75,00%

**NEUTRAL
OPERATOR**

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
973.192,21	810.993,50	810.993,50	810.993,50	810.993,50	810.993,50	648.794,80	648.794,80	648.794,80	648.794,80	486.596,10	0,00	0,00	32.439.740,18
381.854,63	318.212,19	318.212,19	318.212,19	318.212,19	318.212,19	254.569,76	254.569,76	254.569,76	254.569,76	190.927,32	0,00	0,00	12.728.487,77
54.000,00	45.000,00	45.000,00	45.000,00	45.000,00	45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00
1.409.046,84	1.174.205,70	1.174.205,70	1.174.205,70	1.174.205,70	1.174.205,70	939.364,56	939.364,56	939.364,56	939.364,56	704.523,42	0,00	0,00	45.168.227,95
36.635.217,80	37.809.423,50	38.983.629,20	40.157.834,90	41.332.040,60	42.506.246,29	43.445.610,85	44.384.975,41	45.324.339,97	46.263.704,53	46.968.227,95	46.968.227,95	46.968.227,95	
12	10	10	10	10	10	8	8	8	8	6	0	0	
312	322	332	342	352	362	370	378	386	394	400	400	400	
78,00%	80,50%	83,00%	85,50%	88,00%	90,50%	92,50%	94,50%	96,50%	98,50%	100,00%	100,00%	100,00%	

Table AI5b. Expenditures Intermediate Model

ANNEX I. B - EXPENDITURES													
Business plan INTERMEDIATE MODEL													
EXPENDITURES													
(Constant EUROS)	CAPEX INVESTMENT 2,00%	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	
MAINTENANCE		84.543	164.389	239.538	309.990	375.746	436.805	493.166	544.831	591.800	634.071	671.646	
PAYROLLS		280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	
OTHER		35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	
TOTAL EXPENDITURES		399.543	479.389	554.538	624.990	690.746	751.805	808.166	859.831	906.800	949.071	986.646	
												NEUTRAL OPERATOR	
YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
704.523	732.704	756.188	779.673	803.157	826.641	850.125	868.912	887.700	906.487	925.274	939.365	939.365	939.365
280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000
35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000
1.019.523	1.047.704	1.071.188	1.094.673	1.118.157	1.141.641	1.165.125	1.183.912	1.202.700	1.221.487	1.240.274	1.254.365	1.254.365	1.254.365

Table AI6b. Icomes Intermediate Model

ANNEX I. B - INCOMES

Business plan INTERMEDIATE MODEL

TOTAL INCOMES (CONSTANT EUROS)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
RESIDENTIAL RENT INCOMES	384.622,57	747.877,22	1.089.763,94	1.410.282,75	1.709.433,64	1.987.216,60	2.243.631,65	2.478.678,78	2.692.357,98	2.884.669,27	3.055.612,63	3.205.188,07
RESIDENTIAL REGISTRATION INCOMES	200.670,56	189.522,20	178.373,83	167.225,47	156.077,10	144.928,74	133.780,37	122.632,01	111.483,65	100.335,28	89.186,92	78.038,55
TOTAL RESIDENTIAL INCOMES	585.293,13	937.399,41	1.268.137,78	1.577.508,22	1.865.510,74	2.132.145,34	2.377.412,02	2.601.310,79	2.803.841,63	2.985.004,55	3.144.799,55	3.283.226,62
BUSINESS RENT INCOMES	559.690,56	1.088.287,20	1.585.789,92	2.052.198,72	2.487.513,60	2.891.734,56	3.264.861,60	3.606.894,72	3.917.833,92	4.197.679,20	4.446.430,56	4.664.088,00
BUSINESS REGISTRATION INCOMES	42.123,51	39.783,32	37.443,12	35.102,93	32.762,73	30.422,54	28.082,34	25.742,15	23.401,95	21.061,76	18.721,56	16.381,37
TOTAL BUSINESS INCOMES	601.814,07	1.128.070,52	1.623.233,04	2.087.301,65	2.520.276,33	2.922.157,10	3.292.943,94	3.632.636,87	3.941.235,87	4.218.740,96	4.465.152,12	4.680.469,37
P2P (Mobiles and other) RENT INCOMES	95.040,00	184.800,00	269.280,00	348.480,00	422.400,00	491.040,00	554.400,00	612.480,00	665.280,00	712.800,00	755.040,00	792.000,00
P2P (Mobiles and other) REGISTRATION INCOMES	5.196,31	4.907,63	4.618,94	4.330,26	4.041,58	3.752,89	3.464,21	3.175,52	2.886,84	2.598,16	2.309,47	2.020,79
P2P (Xarxa Oberta) RENT INCOMES	60.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00
P2P (Xarxa Oberta) REGISTRATION INCOMES	3.280,50	9.841,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL P2P INCOMES	163.516,81	439.549,13	513.898,94	592.810,26	666.441,58	734.792,89	797.864,21	855.655,52	908.166,84	955.398,16	997.349,47	1.034.020,79
COVERED BLOCKS	36	34	32	30	28	26	24	22	20	18	16	14
ACCUMULATED NUMBER OF COVERED BLOCKS	36	70	102	132	160	186	210	232	252	270	286	300
TOTAL INCOMES	1.350.624,01	2.505.019,06	3.405.269,76	4.257.620,12	5.052.228,65	5.789.095,33	6.468.220,17	7.089.603,17	7.653.244,34	8.159.143,66	8.607.301,14	8.997.716,78

NEUTRAL
OPERATOR

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
3.333.395,60	3.440.235,20	3.547.074,80	3.653.914,40	3.760.754,01	3.867.593,61	3.953.065,29	4.038.536,97	4.124.008,65	4.209.480,34	4.273.584,10	4.273.584,10	4.273.584,10
66.890,19	55.741,82	55.741,82	55.741,82	55.741,82	55.741,82	44.593,46	44.593,46	44.593,46	44.593,46	33.445,09	0,00	0,00
3.400.285,78	3.495.977,02	3.602.816,62	3.709.656,23	3.816.495,83	3.923.335,43	3.997.658,75	4.083.130,43	4.168.602,11	4.254.073,79	4.307.029,19	4.273.584,10	4.273.584,10
4.850.651,52	5.006.121,12	5.161.590,72	5.317.060,32	5.472.529,92	5.627.999,52	5.752.375,20	5.876.750,88	6.001.126,56	6.125.502,24	6.218.784,00	6.218.784,00	6.218.784,00
14.041,17	11.700,98	11.700,98	11.700,98	11.700,98	11.700,98	9.360,78	9.360,78	9.360,78	9.360,78	7.020,59	0,00	0,00
4.864.692,69	5.017.822,10	5.173.291,70	5.328.761,30	5.484.230,90	5.639.700,50	5.761.735,98	5.886.111,66	6.010.487,34	6.134.863,02	6.225.804,59	6.218.784,00	6.218.784,00
823.680,00	850.080,00	876.480,00	902.880,00	929.280,00	955.680,00	976.800,00	997.920,00	1.019.040,00	1.040.160,00	1.056.000,00	1.056.000,00	1.056.000,00
1.732,10	1.443,42	1.443,42	1.443,42	1.443,42	1.443,42	1.154,74	1.154,74	1.154,74	1.154,74	866,05	0,00	0,00
240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00	240.000,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1.065.412,10	1.091.523,42	1.117.923,42	1.144.323,42	1.170.723,42	1.197.123,42	1.217.954,74	1.239.074,74	1.260.194,74	1.281.314,74	1.296.866,05	1.296.000,00	1.296.000,00
12	10	10	10	10	10	8	8	8	8	6	0	0
312	322	332	342	352	362	370	378	386	394	400	400	400
9.330.390,58	9.605.322,54	9.894.031,74	10.182.740,94	10.471.450,14	10.760.159,34	10.977.349,46	11.208.316,83	11.439.284,19	11.670.251,55	11.829.699,83	11.788.368,10	11.788.368,10

Table AI8b. Business plan Optimistic Intermediate

ANNEX I. B BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - INTERMEDIATE MODEL TO 25 YEARS (CONSTANT EUROS)

BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)																					
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Civil Works	10,00%	32.439.740,18	23.709.134,72	2.919.576,62	2.757.377,92	2.595.179,21	2.432.980,51	2.270.781,81	2.108.583,11	1.946.384,41	1.784.185,71	1.621.987,01	1.459.788,31	1.297.589,61	1.135.390,91	973.192,21	810.993,50	810.993,50	810.993,50	810.993,50
2	Fibre	5,00%	12.728.487,77	9.302.831,34	1.145.563,90	1.081.921,46	1.018.279,02	954.636,58	890.994,14	827.351,71	763.709,27	700.066,83	636.424,39	572.781,95	509.139,51	445.497,07	381.854,63	318.212,19	318.212,19	318.212,19	318.212,19
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00	54.000,00	45.000,00	45.000,00	45.000,00	45.000,00
Total			46.968.227,95	34.327.526,61	4.227.140,52	3.992.299,38	3.757.458,24	3.522.617,10	3.287.775,96	3.052.934,82	2.818.093,68	2.583.252,54	2.348.411,40	2.113.570,26	1.878.729,12	1.643.887,98	1.409.046,84	1.174.205,70	1.174.205,70	1.174.205,70	1.174.205,70

AMORTIZATION	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17		
1	Civil Works	11.331.201,24	6.244.780,79	58.391,53	113.539,09	165.442,67	214.102,29	259.517,92	301.689,58	340.617,27	376.300,99	408.740,73	437.936,49	463.888,28	486.596,10	506.059,95	522.279,82	538.499,69	554.719,56	570.939,43	
2	Fibre	8.892.121,56	4.900.570,45	45.822,56	89.099,41	129.830,58	168.016,04	203.655,80	236.749,87	267.298,24	295.300,92	320.757,89	343.669,17	364.034,75	381.854,63	397.128,82	409.857,31	422.585,79	435.314,28	448.042,77	
3	Adaptation of the rooms	1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	33.480,00	37.800,00	41.760,00	45.360,00	48.600,00	51.480,00	54.000,00	56.160,00	57.960,00	59.760,00	61.560,00	63.360,00	
Total			20.223.322,80	11.838.365,76	110.694,09	215.238,51	313.633,25	405.878,32	491.973,73	571.919,46	645.715,52	713.361,90	774.858,62	830.205,66	879.403,03	922.450,74	959.348,77	990.097,12	1.020.845,48	1.051.593,84	1.082.342,20

EXPENDITURES	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17		
1	Maintenance	16.406.002,02	9.041.573,28	84.542,81	164.388,80	239.537,96	309.990,30	375.745,82	436.804,52	493.166,39	544.831,44	591.799,67	634.071,08	671.645,66	704.523,42	732.704,36	756.188,47	779.672,58	803.156,70	826.640,81	
2	Payrolls	7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	
3	Other	875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	
Total			24.281.002,02	13.918.304,32	399.542,81	479.388,80	554.537,96	624.990,30	690.745,82	751.804,52	808.166,39	859.831,44	906.799,67	949.071,08	986.645,66	1.019.523,42	1.047.704,36	1.071.188,47	1.094.672,58	1.118.156,70	1.141.640,81

INCOMES	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17		
1	FIBRE RENT INCOMES	114.698.041,36	1.099.353,13	2.260.964,42	3.184.833,86	4.050.961,47	4.859.347,24	5.609.991,16	6.302.893,25	6.938.053,50	7.515.471,90	8.035.148,47	8.497.083,19	8.901.276,07	9.247.727,12	9.536.436,32	9.825.145,52	10.113.854,72	10.402.563,93	
2	FIBRE REGISTRATION INCOMES	2.026.102,24	251.270,88	244.054,64	220.435,90	206.658,65	192.881,41	179.104,17	165.326,92	151.549,68	137.772,44	123.995,19	110.217,95	96.440,70	82.663,46	68.886,22	68.886,22	68.886,22	68.886,22	
TOTAL			116.724.143,60	1.350.624,01	2.505.019,06	3.405.269,76	4.257.620,12	5.052.228,65	5.789.095,33	6.468.220,17	7.089.603,17	7.653.244,34	8.159.143,66	8.607.301,14	8.997.716,78	9.330.390,58	9.605.322,54	9.894.031,74	10.182.740,94	10.471.450,14

RESULTS	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
RESULT	160.512.392,34	80.316.678,42	-3.165.365,23	-1.751.430,61	-593.093,19	515.891,05	1.565.680,59	2.556.275,45	3.487.675,62	4.359.881,10	5.172.891,88	5.926.707,98	6.621.329,39	7.256.756,12	7.832.988,15	8.350.025,49	8.645.998,94	8.941.972,38	9.237.945,83
IRR	34,79%	-3.165.365,23	-4.916.795,84	-5.509.889,03	-4.993.997,98	-3.428.317,38	-872.041,93	2.615.633,68	6.975.514,78	12.148.406,66	18.075.114,65	24.696.444,04	31.953.200,16	39.786.188,30	48.136.213,79	56.782.212,73	65.724.185,11	74.962.130,94	

NEUTRAL OPERATOR

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
810.993,50	648.794,80	648.794,80	648.794,80	648.794,80	486.596,10	0,00	0,00	32.439.740,18
318.212,19	254.569,76	254.569,76	254.569,76	254.569,76	190.927,32	0,00	0,00	12.728.487,77
45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00
1.174.205,70	939.364,56	939.364,56	939.364,56	939.364,56	704.523,42	0,00	0,00	46.968.227,95

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
587.159,30	600.135,19	613.111,09	626.086,99	639.062,88	648.794,80	648.794,80	648.794,80	11.331.201,24
460.771,26	470.954,05	481.136,84	491.319,63	501.502,42	509.139,51	509.139,51	509.139,51	8.892.121,56
65.160,00	66.600,00	68.040,00	69.480,00	70.920,00	72.000,00	72.000,00	72.000,00	1.257.480,00
1.113.090,55	1.137.689,24	1.162.287,93	1.186.886,61	1.211.485,30	1.229.934,31	1.229.934,31	1.229.934,31	21.480.802,80

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
850.124,93	868.912,22	887.699,51	906.486,80	925.274,09	939.364,56	939.364,56	939.364,56	16.406.002,02
280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00
35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00
1.165.124,93	1.183.912,22	1.202.699,51	1.221.486,80	1.240.274,09	1.254.364,56	1.254.364,56	1.254.364,56	24.281.002,02

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
10.691.273,13	10.922.240,49	11.153.207,85	11.384.175,21	11.615.142,58	11.788.368,10	11.788.368,10	11.788.368,10
68.886,22	55.108,97	55.108,97	55.108,97	55.108,97	41.331,73	0,00	0,00
10.760.159,34	10.977.349,46	11.208.316,83	11.439.284,19	11.670.251,55	11.829.699,83	11.788.368,10	11.788.368,10

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
9.533.919,27	9.991.761,93	10.228.540,69	10.465.319,44	10.702.098,20	11.100.746,16	11.763.937,85	11.763.937,85
84.496.050,21	94.487.812,14	104.716.352,83	115.181.672,27	125.883.770,47	136.984.516,63	148.748.454,48	160.512.392,34

SCENARIO DATA

Rate	7,00%
CPI	2,80%
Real	4,09%

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

C) Business plan pessimistic model

ANNEX I. C SUMMARY OF BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - PESSIMISTIC MODEL TO 25 YEARS (CONSTANT EUROS)													NEUTRAL OPERATOR	
BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)														
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works	5,00%	34.241.947,96	25.026.308,87	3.081.775,32	2.910.565,58	2.739.355,84	2.568.146,10	2.396.936,36	1.540.887,66	856.048,70	684.838,96	0,00	34.241.947,96
2	Fibre	2,50%	13.063.447,98	9.547.642,69	1.175.710,32	1.110.393,08	1.045.075,84	979.758,60	914.441,36	587.855,16	326.586,20	261.268,96	0,00	13.063.447,98
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	81.000,00	45.000,00	36.000,00	0,00	1.800.000,00
Total			49.105.395,94	35.889.512,11	4.419.485,63	4.173.958,66	3.928.431,68	3.682.904,70	3.437.377,72	2.209.742,82	1.227.634,90	982.107,92	0,00	49.105.395,94
AMORTIZATION		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Civil Works		11.960.712,42	6.591.713,06	61.635,51	119.846,82	174.633,93	225.996,86	273.935,58	462.266,30	568.416,34	647.172,82	684.838,96	11.960.712,42
2	Fibre		9.126.124,76	5.029.532,83	47.028,41	91.444,14	133.247,17	172.437,51	209.015,17	352.713,10	433.706,47	493.798,33	522.537,92	9.126.124,76
3	Adaptation of the rooms		1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	48.600,00	59.760,00	68.040,00	72.000,00	1.257.480,00
Total			21.086.837,18	12.314.260,40	115.143,92	223.890,95	326.241,10	422.194,37	511.750,75	863.579,39	1.061.882,81	1.209.011,15	1.279.376,88	22.344.317,18
EXPENDITURES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25	Final projection to 25 years	
1	Maintenance		17.152.514,80	9.452.986,73	88.389,71	171.868,89	250.437,52	324.095,61	392.843,17	662.922,85	815.149,57	928.091,98	982.107,92	17.152.514,80
2	Payrolls		7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00
3	Other		875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00
Total			25.027.514,80	14.329.717,78	403.389,71	486.868,89	565.437,52	639.095,61	707.843,17	977.922,85	1.130.149,57	1.243.091,98	1.297.107,92	25.027.514,80
INCOMES			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
1	FIBRE RENT INCOMES		86.402.506,14	826.714,71	1.693.834,17	2.391.358,36	3.045.287,29	3.655.620,95	6.053.360,36	7.404.813,48	8.407.504,50	8.887.052,38		
2	FIBRE REGISTRATION INCOMES		1.551.127,33	192.249,67	186.289,40	168.847,39	158.294,43	147.741,47	94.976,66	52.764,81	42.211,85	0,00		
TOTAL			87.953.633,48	1.018.964,38	1.880.123,57	2.560.205,75	3.203.581,72	3.803.362,42	6.148.337,02	7.457.578,29	8.449.716,35	8.887.052,38		
RESULTS			NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 10	YEAR 15	YEAR 20	YEAR 25		
RESULT		106.683.434,09	50.048.663,99	-3.688.767,05	-2.556.813,02	-1.607.422,34	-696.224,22	169.892,29	3.824.250,75	6.161.676,62	7.433.527,60	8.869.321,34		
IRR		21,79%		-3.688.767,05	-6.245.580,06	-7.853.002,41	-8.549.226,63	-8.379.334,34	3.884.018,54	30.848.150,80	65.372.357,64	106.683.434,09		
SCENARIO DATA														
Rate		7,00%												
CPI		2,80%												
Real		4,09%												

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

Table AI2c. Investment of civil works Pessimistic Model

ANNEX I. C- INVESTMENT OF CIVIL WORKS					NEUTRAL
Business plan PESSIMISTIC MODEL					OPERATOR
TOTAL INVESTMENT OF CIVIL WORKS PER CITY BLOCK (CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Duct on the footpath (1 tube)	m	240,00	59,05 €	14.172,00 €
1.02	Ducts on the footpath (2 tubes)	m	488,00	74,28 €	36.248,64 €
1.03	Ducts on the road (2 tubes)	m	40,00	124,75 €	4.990,00 €
1.04	Manhole	Ut	12,00	785,72 €	9.428,64 €
3.01	Subtotal				64.839,28 €
1.05	Safety and Health	pa	2,5%		1.620,98 €
3.02	Total Budget Material Execution				66.460,26 €
1.06	General Expenses		13,0%		8.639,83 €
1.07	Industrial Profit		6,0%		3.987,62 €
3.03	Subtotal				79.087,71 €
1.08	Quality Control	pa	2,0%		1.296,79 €
1.09	Services Affected	pa	7,0%		4.538,75 €
1.10	Project Management	pa	8,0%		5.187,14 €
5.01	TOTAL BUDGET PER CITY BLOCK (without applying 7.01)				90.110,39 €
7.01	Use percentage of existing civil works infrastructure			5,0%	4.505,52 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				85.604,87 €

Table AI3c. Investment of fibre Pessimistic Model

ANNEX I. C- INVESTMENT OF FIBRE					NEUTRAL
Business plan PESSIMISTIC MODEL					OPERATOR
TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION PER CITY BLOCK					
(CONSTANT EUROS)					
Code	Concept	Uts	Quantities	Unit Cost	Total
1.01	Fibre Splices	Ut	220,00	15,54 €	3.418,80 €
1.02	Fibre optic cable up to 24 FO	m	65,00	6,81 €	442,65 €
1.03	Fibre optic cable up to 48 FO	m	65,00	7,32 €	475,80 €
1.04	Fibre optic cable up to 144 FO	m	130,00	12,61 €	1.639,30 €
1.05	Fibre optic cable up to 288 FO	m	720,00	17,92 €	12.902,40 €
1.05	Tube of polyethylene 40 mm	m	3.888,00	1,26 €	4.898,88 €
1.06	Splices Box	Ut	4,00	374,00 €	1.496,00 €
1.07	Distribution Racks	Ut	0,25	427,00 €	106,75 €
3.01	Subtotal				25.380,58 €
1.08	Safety and Health	pa	2,5%		634,51 €
3.02	Total Budget Material Execution				26.015,09 €
1.09	General Expenses		13,0%		3.381,96 €
1.10	Industrial Profit		6,0%		1.560,91 €
3.03	Subtotal				30.957,96 €
1.11	Quality Control	pa	2,0%		507,61 €
1.12	Project Management	pa	8,0%		2.030,45 €
5.01	TOTAL BUDGET PER CITY BLOCK				33.496,02 €
7.01	Us percentage of existing fibre infraestructure			2,5%	837,40 €
7.01	TOTAL BUDGET PER CITY BLOCK (applying 7.01)				32.658,62 €

Note: Concepts 1.01, 1.02, 1.03, 1.04, 1.05, 1.06 and 1.07 include supply and installation

Table AI4c. Total Investment Pessimistic Model

ANNEX I. C - TOTAL INVESTMENT OF OPTOMECHANICAL INSTALLATION AND CIVIL WORKS														
Business plan PESSIMISTIC MODEL														
(CONSTANT EUROS)														
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	
1	Civil Works	5,00%	3.081.775,32	2.910.565,58	2.739.355,84	2.568.146,10	2.396.936,36	2.225.726,62	2.054.516,88	1.883.307,14	1.712.097,40	1.540.887,66	1.369.677,92	1.198.468,18
2	Fibre	2,50%	1.175.710,32	1.110.393,08	1.045.075,84	979.758,60	914.441,36	849.124,12	783.806,88	718.489,64	653.172,40	587.855,16	522.537,92	457.220,68
3	Adaptation of the rooms		162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00
Total			4.419.485,63	4.173.958,66	3.928.431,68	3.682.904,70	3.437.377,72	3.191.850,74	2.946.323,76	2.700.796,78	2.455.269,80	2.209.742,82	1.964.215,84	1.718.688,86
Total Accumulated			4.419.485,63	8.593.444,29	12.521.875,97	16.204.780,66	19.642.158,38	22.834.009,11	25.780.332,87	28.481.129,65	30.936.399,44	33.146.142,26	35.110.358,10	36.829.046,96
	COVERED BLOCKS		36	34	32	30	28	26	24	22	20	18	16	14
	ACCUMULATED NUMBER OF COVERED BLOCKS		36	70	102	132	160	186	210	232	252	270	286	300
	(%) Covered blocks of the total		9,00%	17,50%	25,50%	33,00%	40,00%	46,50%	52,50%	58,00%	63,00%	67,50%	71,50%	75,00%

NEUTRAL OPERATOR

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years
1.027.258,44	856.048,70	856.048,70	856.048,70	856.048,70	856.048,70	684.838,96	684.838,96	684.838,96	684.838,96	513.629,22	0,00	0,00	34.241.947,96
391.903,44	326.586,20	326.586,20	326.586,20	326.586,20	326.586,20	261.268,96	261.268,96	261.268,96	261.268,96	195.951,72	0,00	0,00	13.063.447,98
54.000,00	45.000,00	45.000,00	45.000,00	45.000,00	45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00
1.473.161,88	1.227.634,90	1.227.634,90	1.227.634,90	1.227.634,90	1.227.634,90	982.107,92	982.107,92	982.107,92	982.107,92	736.580,94	0,00	0,00	47.305.395,94
38.302.208,83	39.529.843,73	40.757.478,63	41.985.113,53	43.212.748,43	44.440.383,33	45.422.491,25	46.404.599,17	47.386.707,08	48.368.815,00	49.105.395,94	49.105.395,94	49.105.395,94	
12	10	10	10	10	10	8	8	8	8	6	0	0	
312	322	332	342	352	362	370	378	386	394	400	400	400	
78,00%	80,50%	83,00%	85,50%	88,00%	90,50%	92,50%	94,50%	96,50%	98,50%	100,00%	100,00%	100,00%	

Table AI5c. Expenditures Pessimistic Model

ANNEX I. C - EXPENDITURES													
Business plan PESSIMISTIC MODEL													
EXPENDITURES													
(Constant EUROS)	CAPEX INVESTMENT 2,00%	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	
MAINTENANCE		88.390	171.869	250.438	324.096	392.843	456.680	515.607	569.623	618.728	662.923	702.207	
PAYROLLS		280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	
OTHER		35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	
TOTAL EXPENDITURES		403.390	486.869	565.438	639.096	707.843	771.680	830.607	884.623	933.728	977.923	1.017.207	
												NEUTRAL OPERATOR	
YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
736.581	766.044	790.597	815.150	839.702	864.255	888.808	908.450	928.092	947.734	967.376	982.108	982.108	982.108
280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000	280.000
35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000
1.051.581	1.081.044	1.105.597	1.130.150	1.154.702	1.179.255	1.203.808	1.223.450	1.243.092	1.262.734	1.282.376	1.297.108	1.297.108	1.297.108

Table AI6c. Icomes Pessimistic Model

ANNEX I. C - INCOMES

Business plan PESSIMISTIC MODEL

TOTAL INCOMES (CONSTANT EUROS)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
RESIDENTIAL RENT INCOMES	295.863,51	575.290,17	838.279,96	1.084.832,89	1.314.948,95	1.528.628,16	1.725.870,50	1.906.675,98	2.071.044,60	2.218.976,36	2.350.471,25	2.465.529,29
RESIDENTIAL REGISTRATION INCOMES	154.361,97	145.786,31	137.210,64	128.634,98	120.059,31	111.483,65	102.907,98	94.332,32	85.756,65	77.180,99	68.605,32	60.029,66
TOTAL RESIDENTIAL INCOMES	450.225,48	721.076,47	975.490,60	1.213.467,86	1.435.008,26	1.640.111,80	1.828.778,48	2.001.008,30	2.156.801,25	2.296.157,34	2.419.076,57	2.525.558,94
BUSINESS RENT INCOMES	430.531,20	837.144,00	1.219.838,40	1.578.614,40	1.913.472,00	2.224.411,20	2.511.432,00	2.774.534,40	3.013.718,40	3.228.984,00	3.420.331,20	3.587.760,00
BUSINESS REGISTRATION INCOMES	32.402,70	30.602,55	28.802,40	27.002,25	25.202,10	23.401,95	21.601,80	19.801,65	18.001,50	16.201,35	14.401,20	12.601,05
TOTAL BUSINESS INCOMES	462.933,90	867.746,55	1.248.640,80	1.605.616,65	1.938.674,10	2.247.813,15	2.533.033,80	2.794.336,05	3.031.719,90	3.245.185,35	3.434.732,40	3.600.361,05
P2P (Mobiles and other) RENT INCOMES	58.320,00	113.400,00	165.240,00	213.840,00	259.200,00	301.320,00	340.200,00	375.840,00	408.240,00	437.400,00	463.320,00	486.000,00
P2P (Mobiles and other) REGISTRATION INCOMES	3.188,65	3.011,50	2.834,35	2.657,21	2.480,06	2.302,91	2.125,76	1.948,62	1.771,47	1.594,32	1.417,18	1.240,03
P2P (Xarxa Oberta) RENT INCOMES	42.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00
P2P (Xarxa Oberta) REGISTRATION INCOMES	2.296,35	6.889,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL P2P INCOMES	105.805,00	291.300,55	336.074,35	384.497,21	429.680,06	471.622,91	510.325,76	545.788,62	578.011,47	606.994,32	632.737,18	655.240,03
COVERED BLOCKS	36	34	32	30	28	26	24	22	20	18	16	14
ACCUMULATED NUMBER OF COVERED BLOCKS	36	70	102	132	160	186	210	232	252	270	286	300
TOTAL INCOMES	1.018.964,38	1.880.123,57	2.560.205,75	3.203.581,72	3.803.362,42	4.359.547,86	4.872.138,04	5.341.132,96	5.766.532,62	6.148.337,02	6.486.546,15	6.781.160,02

NEUTRAL
OPERATOR

YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
2.564.150,46	2.646.334,77	2.728.519,08	2.810.703,39	2.892.887,70	2.975.072,01	3.040.819,45	3.106.566,90	3.172.314,35	3.238.061,80	3.287.372,38	3.287.372,38	3.287.372,38
51.453,99	42.878,33	42.878,33	42.878,33	42.878,33	42.878,33	34.302,66	34.302,66	34.302,66	34.302,66	25.727,00	0,00	0,00
2.615.604,45	2.689.213,09	2.771.397,40	2.853.581,71	2.935.766,02	3.017.950,33	3.075.122,11	3.140.869,56	3.206.617,01	3.272.364,46	3.313.099,38	3.287.372,38	3.287.372,38
3.731.270,40	3.850.862,40	3.970.454,40	4.090.046,40	4.209.638,40	4.329.230,40	4.424.904,00	4.520.577,60	4.616.251,20	4.711.924,80	4.783.680,00	4.783.680,00	4.783.680,00
10.800,90	9.000,75	9.000,75	9.000,75	9.000,75	9.000,75	7.200,60	7.200,60	7.200,60	7.200,60	5.400,45	0,00	0,00
3.742.071,30	3.859.863,15	3.979.455,15	4.099.047,15	4.218.639,15	4.338.231,15	4.432.104,60	4.527.778,20	4.623.451,80	4.719.125,40	4.789.080,45	4.783.680,00	4.783.680,00
505.440,00	521.640,00	537.840,00	554.040,00	570.240,00	586.440,00	599.400,00	612.360,00	625.320,00	638.280,00	648.000,00	648.000,00	648.000,00
1.062,88	885,74	885,74	885,74	885,74	885,74	708,59	708,59	708,59	708,59	531,44	0,00	0,00
168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00	168.000,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
674.502,88	690.525,74	706.725,74	722.925,74	739.125,74	755.325,74	768.108,59	781.068,59	794.028,59	806.988,59	816.531,44	816.000,00	816.000,00
12	10	10	10	10	10	8	8	8	8	6	0	0
312	322	332	342	352	362	370	378	386	394	400	400	400
7.032.178,63	7.239.601,98	7.457.578,29	7.675.554,60	7.893.530,91	8.111.507,22	8.275.335,30	8.449.716,35	8.624.097,40	8.798.478,44	8.918.711,27	8.887.052,38	8.887.052,38

Table A17c. Amortization Pessimistic Model

ANNEX I. C - AMORTIZATION																											NEUTRAL OPERATOR	
Business plan PESSIMISTIC MODEL																												
FIBRE AND CIVIL WORKS AMORTIZATION																												
INVESTMENT (CONSTANT EUROS)																												
CIVIL WORKS INVESTMENT																												
1- Civil works investment																												
Expected annual investment	34.241.948	3.081.775	2.910.566	2.739.356	2.568.146	2.396.936	2.225.727	2.054.517	1.883.307	1.712.097	1.540.888	1.369.678	1.198.468	1.027.258	856.049	856.049	856.049	856.049	856.049	684.839	684.839	684.839	684.839	513.629	34.241.948	34.241.948	0	
Accumulated	3.081.775	5.992.341	8.731.697	11.299.843	13.696.779	15.922.506	17.977.023	19.860.330	21.572.427	23.113.315	24.482.993	25.681.461	26.708.719	27.564.768	28.420.817	29.276.866	30.132.914	30.988.963	31.673.802	32.358.641	33.043.480	33.728.319	34.241.948	34.241.948	34.241.948	34.241.948	34.241.948	0
FIBRE INVESTMENT																												
2- Fibre investment																												
Expected annual investment	13.063.448	1.175.710	1.110.393	1.045.076	979.759	914.441	849.124	783.807	718.490	653.172	587.855	522.538	457.221	391.903	326.586	326.586	326.586	326.586	326.586	261.269	261.269	261.269	261.269	195.952	0	0	0	0
Accumulated	1.175.710	2.286.103	3.331.179	4.310.938	5.225.379	6.074.503	6.858.310	7.576.800	8.229.972	8.817.827	9.340.365	9.797.586	10.189.489	10.516.076	10.842.662	11.169.248	11.495.834	11.822.420	12.083.689	12.344.958	12.606.227	12.867.496	13.063.448	13.063.448	13.063.448	13.063.448	13.063.448	0
ADAPTATION ROOMS INVESTMENT																												
3- Rooms investment																												
Expected annual investment	1.800.000	162.000	153.000	144.000	135.000	126.000	117.000	108.000	99.000	90.000	81.000	72.000	63.000	54.000	45.000	45.000	45.000	45.000	45.000	45.000	36.000	36.000	36.000	36.000	27.000	0	0	0
Accumulated	162.000	315.000	459.000	594.000	720.000	837.000	945.000	1.044.000	1.134.000	1.215.000	1.287.000	1.350.000	1.404.000	1.449.000	1.494.000	1.539.000	1.584.000	1.629.000	1.665.000	1.701.000	1.737.000	1.773.000	1.800.000	1.800.000	1.800.000	1.800.000	1.800.000	1.800.000
Civil works AMORTIZATION																												
1- Civil works investment																												
Life time	50	Years	3.081.775	2.910.566	2.739.356	2.568.146	2.396.936	2.225.727	2.054.517	1.883.307	1.712.097	1.540.888	1.369.678	1.198.468	1.027.258	856.049	856.049	856.049	856.049	856.049	684.839	684.839	684.839	684.839	513.629	0	0	0
Amortization	YEAR 1	3.081.775	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636	61.636
YEAR 2	2.910.566	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211	58.211
YEAR 3	2.739.356	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787	54.787
YEAR 4	2.568.146	50	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363	51.363
YEAR 5	2.396.936	50	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939	47.939
YEAR 6	2.225.727	50	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515	44.515
YEAR 7	2.054.517	50	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090	41.090
YEAR 8	1.883.307	50	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666	37.666
YEAR 9	1.712.097	50	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242	34.242
YEAR 10	1.540.888	50	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818	30.818
YEAR 11	1.369.678	50	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394	27.394
YEAR 12	1.198.468	50	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969	23.969
YEAR 13	1.027.258	50	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545	20.545
YEAR 14	856.049	50	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121
YEAR 15	856.049	50	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121
YEAR 16	856.049	50	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121
YEAR 17	856.049	50	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121
YEAR 18	856.049	50	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121	17.121
YEAR 19	684.839	50	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	
YEAR 20	684.839	50	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697
YEAR 21	684.839	50	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697
YEAR 22	684.839	50	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697	13.697
YEAR 23	513.629	50	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273	10.273
YEAR 24	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YEAR 25	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Civil works investment provision	0	61.636	119.847	174.634	225.997	273.936	318.450	359.540	397.207	431.449	462.266	489.660	513.629	534.174	551.295	568.416	585.537	602.658	619.779	633.476	647.173	660.870	674.566	684.839	684.839	684.839	684.839	
Fibre Optic AMORTIZATION																												
2- Fibre investment																												
Life time	25	Years	1.175.710	1.110.393	1.045.076	979.759	914.441	849.124	783.807	718.490	653.172	587.855	522.538	457.221	391.903	326.586	326.5											

Table AI8c. Business plan Pessimistic Model

ANNEX I. C BUSINESS PLAN OF THE NEUTRAL DARK FIBRE OPERATOR - PESSIMISTIC MODEL TO 25 YEARS (CONSTANT EUROS)																					
BUSINESS PLAN TO 25 YEARS (CONSTANT EUROS)																					
INVESTMENT	% USE OF EXISTING INFRASTRUCTURE	AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Civil Works	5,00%	34.241.947,96	25.026.308,87	3.081.775,32	2.910.565,58	2.739.355,84	2.568.146,10	2.396.936,36	2.225.726,62	2.054.516,88	1.883.307,14	1.712.097,40	1.540.887,66	1.369.677,92	1.198.468,18	1.027.258,44	856.048,70	856.048,70	856.048,70	856.048,70
2	Fibre	2,50%	13.063.447,98	9.547.642,69	1.175.710,32	1.110.393,08	1.045.075,84	979.758,60	914.441,36	849.124,12	783.806,88	718.489,64	653.172,40	587.855,16	522.537,92	457.220,68	391.903,44	326.586,20	326.586,20	326.586,20	326.586,20
3	Adaptation of the rooms		1.800.000,00	1.315.560,55	162.000,00	153.000,00	144.000,00	135.000,00	126.000,00	117.000,00	108.000,00	99.000,00	90.000,00	81.000,00	72.000,00	63.000,00	54.000,00	45.000,00	45.000,00	45.000,00	45.000,00
Total			49.105.395,94	35.889.512,11	4.419.485,63	4.173.958,66	3.928.431,68	3.682.904,70	3.437.377,72	3.191.850,74	2.946.323,76	2.700.796,78	2.455.269,80	2.209.742,82	1.964.215,84	1.718.688,86	1.473.161,88	1.227.634,90	1.227.634,90	1.227.634,90	1.227.634,90
AMORTIZATION		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Civil Works	11.960.712,42	6.591.713,06	61.635,51	119.846,82	174.633,93	225.996,86	273.935,58	318.450,12	359.540,45	397.206,60	431.448,54	462.266,30	489.659,86	513.629,22	534.174,39	551.295,36	568.416,34	585.537,31	602.658,28	
2	Fibre	9.126.124,76	5.029.532,83	47.028,41	91.444,14	133.247,17	172.437,51	209.015,17	242.980,13	274.332,41	303.071,99	329.198,89	352.713,10	373.614,61	391.903,44	407.579,58	420.643,02	433.706,47	446.769,92	459.833,37	
3	Adaptation of the rooms	1.257.480,00	693.014,52	6.480,00	12.600,00	18.360,00	23.760,00	28.800,00	33.480,00	37.800,00	41.760,00	45.360,00	48.600,00	51.480,00	54.000,00	56.160,00	57.960,00	59.760,00	61.560,00	63.360,00	
Total			21.086.837,18	12.314.260,40	115.143,92	223.890,95	326.241,10	422.194,37	511.750,75	594.910,25	671.672,86	742.038,59	806.007,43	863.579,39	914.754,47	959.532,66	997.913,97	1.029.898,39	1.061.882,81	1.093.867,23	1.125.851,65
EXPENDITURES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	Maintenance	17.152.514,80	9.452.986,73	88.389,71	171.868,89	250.437,52	324.095,61	392.843,17	456.680,18	515.606,66	569.622,59	618.727,99	662.922,85	702.207,16	736.580,94	766.044,18	790.596,87	815.149,57	839.702,27	864.254,97	
2	Payrolls	7.000.000,00	4.334.872,04	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	
3	Other	875.000,00	541.859,01	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	
Total			25.027.514,80	14.329.717,78	403.389,71	486.868,89	565.437,52	639.095,61	707.843,17	771.680,18	830.606,66	884.622,59	933.727,99	977.922,85	1.017.207,16	1.051.580,94	1.081.044,18	1.105.596,87	1.130.149,57	1.154.702,27	1.179.254,97
INCOMES		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
1	FIBRE RENT INCOMES		86.402.506,14	826.714,71	1.693.834,17	2.391.358,36	3.045.287,29	3.655.620,95	4.222.359,36	4.745.502,50	5.225.050,38	5.661.003,00	6.053.360,36	6.402.122,45	6.707.289,29	6.968.860,86	7.186.837,17	7.404.813,48	7.622.789,79	7.840.766,10	
2	FIBRE REGISTRATION INCOMES		1.551.127,33	192.249,67	186.289,40	168.847,39	158.294,43	147.741,47	137.188,51	126.635,54	116.082,58	105.529,62	94.976,66	84.423,70	73.870,73	63.317,77	52.764,81	52.764,81	52.764,81	52.764,81	
TOTAL			87.953.633,48	1.018.964,38	1.880.123,57	2.560.205,75	3.203.581,72	3.803.362,42	4.359.547,86	4.872.138,04	5.341.132,96	5.766.532,62	6.148.337,02	6.486.546,15	6.781.160,02	7.032.178,63	7.239.601,98	7.457.578,29	7.675.554,60	7.893.530,91	
RESULTS		AMOUNT	NPV	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13	YEAR 14	YEAR 15	YEAR 16	YEAR 17	
RESULT		106.683.434,09	50.048.663,99	-3.688.767,05	-2.556.813,02	-1.607.422,34	-696.224,22	169.892,29	990.927,19	1.766.880,49	2.497.752,18	3.183.542,27	3.824.250,75	4.419.877,62	4.970.422,88	5.475.886,54	5.936.268,59	6.161.676,62	6.387.084,66	6.612.492,69	
IRR		21,79%		-3.688.767,05	-6.245.580,06	-7.853.002,41	-8.549.226,63	-8.379.334,34	-7.388.407,15	-5.621.526,65	-3.123.774,47	59.767,80	3.884.018,54	8.303.896,16	13.274.319,04	18.750.205,58	24.686.474,17	30.848.150,80	37.235.235,46	43.847.728,15	

NEUTRAL OPERATOR									
YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years	
856.048,70	684.838,96	684.838,96	684.838,96	684.838,96	513.629,22	0,00	0,00	34.241.947,96	
326.586,20	261.268,96	261.268,96	261.268,96	261.268,96	195.951,72	0,00	0,00	13.063.447,98	
45.000,00	36.000,00	36.000,00	36.000,00	36.000,00	27.000,00	0,00	0,00	1.800.000,00	
1.227.634,90	982.107,92	982.107,92	982.107,92	982.107,92	736.580,94	0,00	0,00	49.105.395,94	

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years	
619.779,26	633.476,04	647.172,82	660.869,60	674.566,37	684.838,96	684.838,96	684.838,96	11.960.712,42	
472.896,82	483.347,58	493.798,33	504.249,09	514.699,85	522.537,92	522.537,92	522.537,92	9.126.124,76	
65.160,00	66.600,00	68.040,00	69.480,00	70.920,00	72.000,00	72.000,00	72.000,00	1.257.480,00	
1.157.836,07	1.183.423,61	1.209.011,15	1.234.598,69	1.260.186,23	1.279.376,88	1.279.376,88	1.279.376,88	22.344.317,18	

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25	Final projection to 25 years	
888.807,67	908.449,82	928.091,98	947.734,14	967.376,30	982.107,92	982.107,92	982.107,92	17.152.514,80	
280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	280.000,00	7.000.000,00	
35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	875.000,00	
1.203.807,67	1.223.449,82	1.243.091,98	1.262.734,14	1.282.376,30	1.297.107,92	1.297.107,92	1.297.107,92	25.027.514,80	

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
8.058.742,41	8.233.123,45	8.407.504,50	8.581.885,55	8.756.266,60	8.887.052,38	8.887.052,38	8.887.052,38
52.764,81	42.211,85	42.211,85	42.211,85	42.211,85	31.658,89	0,00	0,00
8.111.507,22	8.275.335,30	8.449.716,35	8.624.097,40	8.798.478,44	8.918.711,27	8.887.052,38	8.887.052,38

YEAR 18	YEAR 19	YEAR 20	YEAR 21	YEAR 22	YEAR 23	YEAR 24	YEAR 25
6.837.900,73	7.253.201,17	7.433.527,60	7.613.854,02	7.794.180,45	8.164.399,29	8.869.321,34	8.869.321,34
50.685.628,88	57.938.830,05	65.372.357,64	72.986.211,67	80.780.392,12	88.944.791,41	97.814.112,75	106.683.434,09

SCENARIO DATA		
Rate		7,00%
CPI		2,80%
Real		4,09%

$$Real = \left(\frac{1 + Rate}{1 + CPI} \right) - 1$$

ANNEX II. CMT Circular 1/2010 on the establishment of the conditions for the exploitation of networks and the provision of electronic communications services by Public Administrations

First. Purpose

1. This Circular aims to identify the conditions for the exploitation of networks and the provision of electronic communications services by public administrations and entities in which public authorities may exercise, directly or indirectly, a dominant influence or effective control by reason of ownership, financial participation or the rules which govern, in accordance the provisions of Article 42.1. of the Commercial Code and in Article 2b) of Directive 2006/111/EC of the European Commission of November 16, 2006, in development of the provisions of the articles 8.4 of Law 32/2003 of November 3, General of Telecommunications and the Regulation on conditions for the provision of electronic communications services, the universal service and protection of users, approved by Royal Decree 424/2005 of 15 April.

2. It should be noted that public administrations are understood as entities in which public authorities may exercise directly or indirectly a dominant influence by virtue of the ownership, of the financial participation or the rules that govern it.

3. It is excluded from the scope of this Circular the terrestrial stations single frequency network for the public diffusion of digital terrestrial television service, which are governed by the additional Provision of Royal Decree 944/2005, of 29 July, and that is included in the National Technical Plan of the digital terrestrial television.

Second. Registration obligation to the exploitation of public networks and the provision of electronic communications services available to the public by public administrations

The exploitation of public networks or the provision of electronic communications services available to the public by public administrations should be notified to the CMT in accordance with the provisions of Article 6.2 of Law 32/2003 of November 3, General Telecommunications, under the terms provided in this Circular, with the sole exception of the cases of self-provision contained in Article Third and point 2 of the Annex to this circular.

Third. Self-provision

1. It is considered self-provision and, therefore, not be necessary to carry out the notification provided for in Article 6.2 of Law 32/2003 of November 3, General of Telecommunications to the CMT, the exploitation of networks and

the provision of electronic communications services by a public administration for the satisfaction of their needs, that is, those linked to the self-functions of the public staff administration concerned and contribute to achieving the aims of its own.

2. In this assumption include the education centres or formal teaching formation at the education system provided for the Organic Law 2 / 2006 of 3 May, on Education and the Organic Law 6 / 2001 of 21 December, on Universities as , among others, schools, institutes, colleges and universities as well as the area of its campus, meaning that both the teachers and the students are part of the essential staff for the performance of the functions of both teachers and learners. It is understood that services are linked to the satisfaction of their needs when networks and / or services are used to serve interpersonal communication between teacher and student and for specific content of such activities.

3. In the assumptions where leveraging the same infrastructure through which the public administration is providing service in regime of self-provision, is provided services, wholesale or retail, third parties, the Public Administration will be considered, as regards these latter, exploitative networks or service provider of electronic communications to third parties, thus remaining subject to the provisions for the operation of telecommunication networks to third parties.

Fourth. *General principles of action*

1. A Public Administration that wants to exploit public networks or electronic communications services available to the public, must act in accordance with the principle investor in a market economy.

2. Public Administrations must operate networks and electronic communications services with appropriate separation of accounts and in accordance with principles of neutrality, transparency and no discrimination.

3. If the regulatory public administrations or holders in the public domain that hold the property or exercise direct control or indirect of operators that operate public networks of electronic communications, must maintain a structural separation between those operators and the organs responsible for the regulation and management of these rights.

4. Without prejudice what is stated in the preceding paragraphs, the Public Administrations, in the development of their business as operators of electronic communications, shall be subject to compliance with the same obligations as private operators of networks and electronic communications services for which, must ensure, inter alia, compliance with its obligations of protection of personal data and privacy of individuals, the rights of users, interoperability of services, quality service obligations, the secret of communications and interception of electronic communications in the cases legally established, as well as the conservation of data provided in the Law 25/2007 of 18 October, preservation of

data relating to electronic communications and public communications networks.

Fifth. *Private investment concept in a market economy.*

1. Private investor is defined as one who performs an economic activity according to the parameters of any operator with business interests, financing their activity in the market conditions for incomes to exceed the costs incurred for benefits, including benefits from their activity.

2. A Public Administration complies with the principle of the private investor in a market economy when acts in accordance with the following criteria:

a) To be the activity aimed at obtaining positive returns, through the income, consistent with the commonly available on the market, all costs of provision, recurring and non-recurring, more an adequate return on capital, taking into account the assumed risk of the investment. According this aspect must be a solid business plan, coherent and plausible hypothesis.

b) Generate the project a positive cash flow during the relevant period. To the extent that horizon of generation of a positive cash flow in net terms is delayed, that fact must be reflected in the project risk and the required return.

3. The presence of private investors in a significant percentage of the capital of the company that make the provision of service, provided that public participation assumes the same risks as the private and that makes on a business plan based, is an indicator of profitability expected positive of a project and, therefore, its consistency with the principle of the private investor in a market economy.

4. For the accreditation of compliance with the principle of private investor in a market economy, the Public Administration must submit to the CMT a business plan containing detailed information, among others, the dimensioning of the network and / or service , incomes and expected costs and sources of financing.

Sixth. *Financing through advertising or sponsorship*

It is understood also that the Public Administration operates according the principle of the private investor in a market economy when finance its activity of exploitation of public networks or the provision of electronic communications services available to the public by means of resources obtained through advertising or sponsorship, provided that the price of these, is oriented to the market so that is similar to the price paid by them on other platforms equivalent. Thus:

a) The Public Administration notify the CMT when electronic communications activities are financed through resources obtained through advertising or

sponsorship and the identity of the companies that advertise or promote the activity. To this end, in the first half of each year, transmit to the CMT the relationship of the companies that have sponsored or advertised during the previous year.

b) May not act as sponsors or advertisers those entities that receive some sort of subsidy of public administration where the telecommunications activity to be financed through advertising or sponsorship. Similarly, nor shall be financed the activity of the public operator by advertising or institutional sponsorship themselves public administrations that exercising control over the corresponding operator.

c) In the case that commercial companies or private foundations advertisers receives funds from other different Public Administration of the network ownership or provider of electronic communications service, should respect the link between resources and the purpose for which they were issued so in no case be applied to activities that somehow involved in their transfer to the financing of the telecommunications activities of public administrations.

d) The Public Administration that carrying out electronic communications activities must be identified to all entities that finance them through their advertising or sponsorship.

e) The publicly owned corporations and public foundations may in no case act as sponsors of the network or electronic communications services available to the public of the Public Administrations.

f) The Savings Bank in which Public Administration exercising effective control over its governing bodies, may not develop the financing activity through advertising or sponsorship public network or electronic communications services available to the public of that Administration Public. In consequence, shall be excluded in these cases their financing to be possible for those entities which do not have that control, provided they meet the necessary guarantees of transparency. It also excludes the possibility of developing advertising or sponsorship activities for those Savings Banks receiving some type of funds, including grants, Public Administration concerned.

Seventh. Separation of accounts

To carry out compliance with the requirement to keep accounts, the Public Administrations must submit to the CMT in the first quarter of each year the separate accounts corresponding to their telecommunications activities available to the public in the previous year, except those relating to the activities listed in the Annex to this Circular must be submitted only at the request of CMT.

Eighth. *Conditions applicable for the exploitation of networks or the provision of service with monetary compensation under the cost with the transitional character in projects developed under the principle of private investor*

1. When a Public Administration, even pretending to operate a network or electronic communications services under the private investor, want to make any of these activities temporarily free of charge or for a fee less than the cost, must be communicated on account of business objectives, to the CMT to establish the period within which may carry out such exploitation or provision and the conditions which must adjust its activities during that period.

2. The Public Administration to conduct an electronic communications activity in these conditions shall inform users of the duration of the period in which the consideration for the service will be less than the cost and the price which shall require the same at the end of this period.

Ninth. *Communication to the European Commission when the Public Administration seeks not to act as a private investor*

When a Public Administration seeking the operation of networks or the provision of electronic communications services to third parties without being subject to private investor, they must notify the project to the European Commission unless there is no State aid or, in accordance with established by Regulation 1998/2006 of 15 December 2006 concerning the implementation of Articles 87 and 88 of the Treaty to of minimum aid, are exempt from being reported.

Tenth. *Notification and communication to the CMT of the exploitation of public networks and provision of electronic communications services available to the public for the Public Administrations without acting under the principle of a private investor*

1. Prior to notification to the European Commission, or when such notice is not mandatory, before starting the rendering of services, the Public Administration aimed at exploiting networks or provide services without being subject to the private investor principle, besides the necessary registration in accordance with the provisions of Article 6.2 of Law 32/2003 of November 3, General Telecommunications, must notify the CMT, to the effect that must consider whether the imposition of conditions as provided in Article 8.4 of Law 32/2003 of November 3, General of Telecommunications. In this communication indicated or attached:

a) The technical condition of the network or the provision of service. If it were the Internet access service that includes, inter alia, network technology, the speed of upload and download, the duration of the connection per user and day, hours of provision, the content accessible.

b) The scope of coverage of the service or network, indicating whether there are other operators providing similar services in the affected areas, and providing a

detailed map of it. Regarding the provision of Internet access service should indicate the locations in which the service is offered and their characteristics (if these are outdoor or indoor and among the latter shall describe the type of activities carried out under the same).

c) The requirements established by the Administration to be beneficiary of the service.

d) Business Plan, which amplify, inter alia, the expected income and sources of financing.

e) A report of competition where a trial is included to weighting whether the measure is justified and is proportionate to the end to be achieved taking into account their potential impact on competition. For this purpose, Public Administrations has at their disposition the "Guide for the preparation of reports for the competence of regulatory projects" published by the National Competition Commission.

f) The results of public consultation that will have to perform, under the terms stipulated in the following section, to collect the sector views on the project.

2. In the public consultation, that in the appropriate cases the notification on the European Commission will always be prior, Public Administrations shall make available to the operators all the information provided in letters a) to f) of the previous section and request information to the operators about similar networks or services provided or plan to provide in the geographic area affected now or in the next three years and how they understand that the project would affect to the competition.

3. Without prejudice to the notification of the public consultation to those interested in the manner prescribed in the rules, the Public Administration must inform to the CMT of the same in order to post it on your website.

4. After receiving all the above information, CMT will develop an analysis of substitutability of services that are intended to provide and be studied how the project could affect competition. If it is understood that could adversely affect, the CMT will make a resolution, within three months after it has been sent all the required information, establishing the conditions which must be subject of public administration to ensure that there is no distortion of competition.

5. Given the resolution or elapsed the expiry of three months since the CMT had all the necessary information, the Public Administration, once adapted his project under that resolution, may notify his project to European Commission or, should this not be prescriptive, to start providing services notified.

Eleventh. *Exploitation of networks and provision of electronic communications services available to the public that do not affect free competition*

1. It is understood that the operation of networks or the provision of electronic communications services does not affect competition, and can therefore make for an indefinite period, even if is not subject to the private investor principle when carrying out any of the provisions contained in the Annex to this Circular.

2. In these cases not necessary to perform the detailed communication provided for in the preceding paragraph will be sufficient if the inscription in the register of operators or for later inclusion in the same, becomes apparent that the service to be provided in the Annex to the Circular. This communication shall not be necessary when, in accordance with the provision in the second article of this Circular, is not mandatory the registration of operators.

3. The Annex to the Circular may be amended by Resolution of the CMT after completion the corresponding analysis of substitutability and public consultation. The resolution so adopted shall be published in the Official Gazette.

Twelfth. Sanctioning regime

Failure to comply with the provisions of this Circular shall be punished accordance with the provisions of Law 32/2003 of November 3, General Telecommunications and other applicable legislation about sanctioning.

ANNEX of the Circular 1/2010

Exploitation of networks and provision of electronic communications services that not affect the competition

It is understood that not affect to the competition the following services:

1. The Internet access service limited to the websites of the Administrations which are responsible for the geographic area in which this service is provided.
2. General service Internet access in libraries as indispensable to comply their goals and as long as users demonstrate its link with the service through some other document that can be identified.
3. General Service Internet access in schools to promote educational activities and cultural, as is essential to comply their goals and as long as users demonstrate its link with the service through some other document that can be identified.
4. The operation of wireless networks that use bands in common use and the provision of electronic communications services available to the public through the same provided that the network coverage, excluding residential buildings and the speed limit to 256Kbps from the user's network.

ANNEX III. European Commission report, State aid N 407/2009 – Spain Optical fibre Catalonia (Xarxa Oberta)

I. SUMMARY

- (1) The European Commission has assessed the measure "*Optical fibre Catalonia (Xarxa Oberta)*" (hereafter: "the measure") and decided not to raise objections because the measure is compatible with the internal market, pursuant to Article 107(3)(c) of the Treaty on the Functioning of the European Union (TFEU).

II. PROCEDURE

- (2) Following pre-notification discussions, by letter dated 08/07/2009, pursuant to Article 108 (3) of the TFEU, the Spanish authorities notified to the Commission a measure for supporting the deployment of an optical fibre network covering 281 municipalities in Catalonia.
- (3) The Commission requested additional information on the measure by letters registered on 09/09/2009, 15/02/2010 and 7/05/2010. The Spanish authorities provided the requested information on the measure by letters registered on 08/10/2010, 15/12/2009, 25/02/2010, 10/03/2010, 12/05/2010 and 02/07/2010. Several meetings, conference calls and email exchanges took place over the course of the notification process. The Spanish authorities proposed a substantial modification of the project on 18 May 2010, formally submitted on 2 July 2010.
- (4) By letter dated 23/03/2010 the Spanish National Regulatory Authority (Comisión del Mercado de las Telecomunicaciones, hereafter "CMT"), submitted to the Commission market data regarding the availability in the areas targeted by the measure (i.e. in the Catalonia region) of access networks, ULL based broadband operators, backhaul and dark fibre infrastructure. The Commission transmitted the CMT report to the Spanish authorities and they provided their comments on the report by email of 8 April 2010.
- (5) On 22/12/2009 and on 05/05/2010 Telefónica, the Spanish incumbent telecommunication operator, submitted to the Commission its observations on the project. These were transmitted for comments to the Spanish authorities, whose reply was sent to the Commission on 13/05/2010.

III. CONTEXT

III.1. The Catalonia region

- (6) Catalonia is an autonomous region of Spain located in the North East of the country. It exercises its self-government, in accordance with the Spanish constitution, with the main institutional body being the *Generalitat de Catalunya*. The region has a population of over 7 million inhabitants and its

territory is divided up into 946 municipalities grouped in 41 supra-municipal counties (called *comarca*). Besides the central regional government, all counties and municipalities have their own competences and services.

- (7) The Generalitat is well aware of the importance of information society services and considers that information and communication technologies (ICT) that shape the knowledge society are one of the forces that will enable the growth of modern economy and contribute to the economic and social development. For these reasons, the Generalitat set as one of the priority objectives in its 2007-2010 Government Plan the consolidation of a dynamic economy in a sustainable environment via the rollout of, *inter alia*, electronic communications networks.
- (8) To fulfil their objectives and foster the roll-out of high speed broadband networks, the regional authorities have undertaken a number of initiatives, such as coordination and rationalisation of civil engineering works, resolutions to promote the extension of electronic communication networks in Catalonia and setting as their objective that all local authorities, businesses and citizens in Catalonia should have the possibility to obtain broadband access at competitive conditions.

III.2. The rationale for public intervention

- (9) According to the Spanish authorities, the development of broadband in Catalonia faces two key problems: (1) the first is the lack of infrastructure to deliver the services required by the public authorities and by citizens; and (2) the second is linked to the lack of adequate competition reflected in high prices or inadequate services.

Shortage of infrastructures from commercial operators to offer broadband services

- (10) As regards the first concern, similarly to other regions in the European Union, also in the case of Catalonia, advanced broadband services and the infrastructures required to support them are available for citizens and businesses in more densely populated areas, whereas broadband infrastructure is inadequate or outright lacking in other areas which are not commercially attractive for electronic communication operators. This leaves citizens and businesses in such areas without the possibility of adequate broadband access and services.
- (11) The Spanish authorities submitted that, based on the information published by the National Regulatory Authority in 2008, only 0.7% of all accesses installed are made on optical fibre in Catalonia and most of these are in Barcelona. The Spanish authorities stress that no commercial operator is planning to deploy NGA networks in the near future of 3 years – on the contrary, all of them have reduced significantly their investment budgets due to the economic and financial crisis started at the end of 2008. According to the report of CMT, telecom investments fell for the second

year in a row in 2009, by 17.3 percent, compared to a 10.6 percent drop in 2008.

Lack of adequate competition reflected in high prices or inadequate services.

(12) As regards the second concern, according to the Spanish authorities, there is a lack of competition as regards of wholesale and retail bandwidth services in many areas of Catalonia. They assert that the broadband share in Catalonia held by the incumbent operator (Telefónica) is 62.2%, without taking into account the indirect share attributable to it due to line rental to other operators.

(13) As regards pricing, the Spanish authorities assert that in Spain, the price of the best medium-speed broadband offering (from 2 to 10 Mbps, a range that covers 72.4% of market lines) is 44.3% higher than the average price of the best offerings in the European Union, taking into account the figures of all the reference operators. For example, according to the Spanish authorities, in up to 898 of all municipalities of Catalonia, having less than 40.000 inhabitants or not located in Barcelona's Metropolitan area, the prices that end-users such as the Generalitat have to pay for advanced broadband connectivity are very high or that high-capacity services – i.e. next generation services of at least 100 Mbit/s – are not available at all. Moreover, even in the 48 remaining municipalities (with more than 40.000 inhabitants or located in Barcelona's metropolitan area) services of up to 1 Gbit/s are provided only on request, their viability is not guaranteed and the prices charged are very high and fluctuating.

Existing networks are not sufficient to satisfy the continuously growing needs of public administration, citizens and business users in the area in question

(14) According to the analysis presented by the Spanish authorities, the inadequacy of existing broadband connections will prove to be a serious bottleneck for providing citizens and companies in the region with many new advanced services and can seriously hamper their activity.

(15) Thanks to progress and technological development, the Spanish authorities argue that advances in the health care field, will soon make it possible for the public authorities to introduce services such as shared clinical histories (which include heavy high-definition images), remote medical imaging (for exchange of radiological diagnostic examinations), telemedicine and remote assistance. Elearning is also expected to grow very fast, thanks to services such as virtual training, remote laboratories, digital remote libraries and virtual meeting points. Additionally, substantial improvements in the justice, security and e-Government fields will be generated by services such as remote interrogations, centralised data services (including multimedia) and remote surveillance.

The rationale for rolling out a new network

- (16) As a consequence of the above described situation, the Regional government of Catalonia has pointed out that for the public administration to live up to the growing expectations of its citizens as regards the provision of advanced e-government, education and health care services, all its departments, including those situated in the most remote areas, need a conspicuous increase of the current broadband capacity, speed and connectivity services. The Spanish authorities argue that the current situation cannot be remedied by alternative instruments (such as demand side measures, regulations, etc.): the market problem in Catalonia is not a problem of regulation of next generation internet services, it is instead a problem of lack of infrastructure. Hence they argue that there are no less distortive means (including ex ante regulation) to reach the goal of providing very high speed, reliable and affordable connectivity services in the region.
- (17) On the basis of the internal evaluation of the availability of infrastructure and existing commercial offer of connectivity services, the Spanish authorities stated that their public interest goals are best achieved through the rollout of a new public broadband infrastructure connecting all the public administration sites.
- (18) Furthermore, in order to alleviate the other disadvantages of the existing situation, i.e. to meet current and future private demand for very high capacity broadband and to foster competitive provision of broadband services, the Generalitat plans to make it possible to private operators to obtain access to the public infrastructure it intends to build for its own internal use. By selling the spare capacity of the network to such operators, it would generate additional revenue covering part of the overall investment cost.
- (19) The Spanish authorities argue that the measure is fully in line with the objectives of the EU as highlighted recently in the EU2020 strategy and the Digital Agenda. The Spanish authorities argue that according to public information, the EU needs an investment in excess of €200-300 billion to deploy NGA networks capable of allowing the economies of Member States to compete with Asia or the U.S. In this connection, there is a risk that countries such as Spain with major deficits will be unable to invest to the necessary extent and that the existing digital divide will widen as a result. The Spanish authorities stress that this is precisely the backdrop to the Xarxa Oberta project and therefore the project is considered necessary to ensure competitive Internet access to the citizens of Catalonia.

IV. DESCRIPTION OF THE MEASURE

- (20) **Objective:** The goal of the Spanish authorities is to provide government departments and agencies, public administration bodies, end users, residential customers and business users with the ability to access the electronic communication operator and technological platform of their choice and to have access to the services provided on NGA networks.

- (21) **Legal basis:** The measure is based on the Agreement of the Government of the Generalitat of Catalonia adopted on 29.07.2008. The adoption of the said agreement forms part of the Governmental Plan 2007-2010, which provides a basis for the promotion of a strong and dynamic economy within a sustainable region pursuant to Decree 205/2007 of 18 September. The Secretariat of Telecommunications and Information Society is entrusted with elaboration of a plan of the notified measure.
- (22) **Design of the project:** To achieve the final goal mentioned above, the measure notified by the Spanish authorities aims at fulfilling two different objectives. The first one is the self-provision of advanced telecommunications services (hereafter, "*self-provision sub-project*") to 4.285 public administration sites, including healthcare and education establishments, security and government bodies, libraries, etc., located in 281 municipalities of Catalonia. The second objective pursued is the provision of wholesale connectivity services on the private market in those areas of the region where such services are non existent or inadequate (hereafter "*wholesale sub-project*").

The self-provision sub-project

- (23) The Generalitat is currently procuring on the private market connectivity services for all the public administration sites of the region, including government departments and agencies, health care institutions, education bodies, etc. The Generalitat has conducted an internal estimate of the growth in the connectivity needs of the public administration. On the basis of the knowledge of the relevant parameters per each public administration site, the regional government has estimated the growth in the individual bandwidth requirements per site and then has summed them up to obtain an estimate of the future needs of all public administration sites under the responsibility of the Generalitat.
- (24) On the basis of the internal process of evaluation, the Generalitat concluded that (i) the existing infrastructures and services offered by commercial operators do not ensure that NGA-type of services will be available in the near future to satisfy the growing connectivity needs of the public administration; and (ii) the estimated prices for such advanced services (if they were available) would be so high as to make it economically feasible for the regional government to build its own NGA network for internal use, instead of purchasing connectivity services on the private market. Furthermore, (iii) not many operators can provide end-user services to the Generalitat as they do not have an infrastructure available.
- (25) On the basis of the above analysis the regional government of Catalonia deliberated to fund the rollout of its own NGA network for internal use by the public administration. The Spanish authorities explained that this type of network will not be used for commercial purposes, but will aim at the provision of services to bodies all forming part of the public administration and exercising public functions in the territory of Catalonia. Hence, in their

view, such State intervention does not involve the granting of an economic advantage to undertakings and consequently falls outside State aid rules.

- (26) The Spanish authorities argue that the public entities mentioned above perform noneconomic activities, therefore there cannot be any State aid in their regard, in line with the precedents of the Prague and the Welsh Public Sector cases and to paragraph (13) of the Broadband Guidelines. In their view, the reduction of costs for the broadband services borne by the Generalitat cannot be regarded as an advantage to an economic activity nor does it entail the use of public resources.
- (27) In any event, even if some of the public entities could conceivably be considered as performing an economic activity (such as health care providers) – thus potentially, recipients of an "advantage" – the Spanish authorities put forward that such entities are operating in the context of services of general economic interest. The Spanish authorities have given assurance that they would only grant this aid to public entities performing an economic activity in the framework of Commission Decision 2005/842/EC on the application of Article 86(2) of the EC Treaty to State aid in the form of compensation for the operation of services of general economic interest (SGEI), and in compliance with all the conditions set by this Decision. Hence this part of the aid measure is not covered by the present decision.

The wholesale sub-project

- (28) The above mentioned insufficiency of existing infrastructures and planned ones to provide adequate NGA services to end users in Catalonia does not affect only the public administration but also citizens and businesses located in the region. For this reason, the regional government wishes to make available at wholesale level to private operators the excess capacity of the Xarxa Oberta.
- (29) By giving wholesale access to spare capacity of the backhaul part of the Xarxa Oberta to electronic operators wishing to connect to it, the Generalitat aims to encourage private investment in NGA networks (i.e. last mile infrastructures) by electronic communication operators so as to accelerate the supply of NGA services to end users. This initiative will ensure that all potential end-users will be able to choose the operator of electronic communications and/or technology platform for broadband access they deem most appropriate to their needs by providing an NGA network that is able to support high-bandwidth, high reliability and affordable connectivity services. Additionally, as a secondary objective, the regional government aims also to reduce the digital divide in those areas in which not even basic broadband services are currently provided.
- (30) The Spanish authorities assert that a market failure is present in Catalonia as regards the provision of NGA services and, in some areas, also of basic broadband services and therefore, they consider State intervention necessary to correct it. Therefore, for this part of the project, the Spanish authorities have requested an authorisation following State aid

rules and the *Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks* (hereafter: the "Broadband Guidelines").

- (31) **Budget and funding instruments:** Instead of the direct funding of the network rollout, the Spanish authorities intend to follow the model of project financing: an independent private company will be selected, through an open tender, to rollout, manage and operate the network and to provide electronic communications services to the public administration for a period of 20 to 30 years. The excess capacity of the network – i.e. the remaining capacity after supplying connectivity to the public administration – will be at the disposal of the selected undertaking for the provision of wholesale connectivity services on the private market.
- (32) The selected undertaking is expected to cover the costs of rolling out the Xarxa Oberta via two channels: the revenues for the provision of connectivity services to the public administration and the revenues for the supply of wholesale services to private operators. As regards the former, the regional government will pay for the connectivity services provided to all public administration sites during all the 20 to 30 years duration of the contract. The Spanish authorities capped the maximum admissible cost per connected public administration site to €1.050 EUR per month. The actual cost per site will be determined during the course of the open tender. The Spanish authorities will also introduce a cap on the maximum rate of return that the selected operator will be allowed to generate from serving the public bodies of Catalonia.
- (33) At the end of the concession, all the assets (i.e. the network elements and all support systems for the network operation) will be transferred back to the Generalitat, without any additional payment. The assets to be transferred include all parts of the network, i.e. both those already existing at the time of the project and those which will be built by the operator during the contract lifetime.
- (34) The total investment required for the assets is estimated at €354 million by the Spanish authorities (without VAT and not on present value).
- (35) In order to facilitate the deployment of the network, the regional government envisages to transfer the existing fibre infrastructure owned by the Generalitat to the selected operator so that such fibre can be integrated in the new network. According to the information submitted, the book value of the transferred infrastructure is [*the information in is covered by the obligation of professional secrecy*] EUR. In the view of the Spanish authorities, a share of it proportional to the capacity devoted to the wholesale subproject has to be considered State aid.
- (36) **Aid amount and intensity:** The Spanish authorities consider the building of the network for self-provision purposes as falling outside the scope of State aid rules. Nevertheless, since the network thus built will be used not only for the self provision but also for the provision of wholesale services, the Spanish authorities have notified the measure as they

consider that the latter requires state aid to be commercially viable and that the amount needed is above the notifiable thresholds.

- (37) **Mapping and coverage analysis:** The pattern that the network will follow is dictated by the need to connect all the public administration sites. However, to identify the municipalities in need of State-funded wholesale broadband infrastructure, mapping of existing infrastructure and coverage analysis is necessary. Initially, the Generalitat conducted a market analysis on the basis of the information publicly available to determine the areas to be targeted. The information collected by the Generalitat was aggregated on the assumption that the wholesale subproject is aimed predominantly at the provision of NGA services and that only high capacity services of at least 100 Mbit/s will be provided by connecting to the Xarxa Oberta.
- (38) On the basis of the market and coverage analysis, the Spanish authorities came to the conclusion that deployment of NGA infrastructure is very limited in the region (Telefónica is experimenting with pilot projects in Barcelona). Concerning basic broadband infrastructure, only Telefónica has an almost region wide coverage, the infrastructure of alternative operators' infrastructures are either (1) mainly concentrated in the most densely populated areas of Catalonia or (2) almost exclusively serving business customers; or (3) their infrastructure is located outside urban settlements, and provide only basic passive infrastructure facilities.
- (39) **Public consultation:** The regional government has undertaken twice a public consultation to verify the results of its mapping and to obtain the opinion of other stakeholders on the project. First, they have contacted service providers directly and second, they have published the details of the Xarxa Oberta project on the website of the Generalitat of Catalonia describing the objectives of the measure, its main characteristics, the list of the targeted areas and requested all stakeholders to provide information on existing and planned NGA and fibre investments as well as their view on the project.
- (40) Of the stakeholders which submitted an answer to the public consultation, 3 were organizations representing interest groups (IT and telecommunications companies), 1 was a public consortium comprising more than 800 municipalities of Catalonia with the objective to promote and deploy IT and communications networks; finally 6 were private electronic communications operators (Abertis, Alpi-Orange Catalunya, BT, ONO, Telefónica, Vodafone).
- (41) The Spanish authorities informed the Commission that no operator indicated any existing or planned investment in NGA networks outside Barcelona and the other provincial capitals. In the opinion of the Generalitat, the absence of submissions from operators of pure passive infrastructure (i.e. dark fibre, as opposed to backhaul) shall be interpreted in the sense that such operators do not consider the "Xarxa Oberta" project as a competing new infrastructure but rather as a potential "customer" which will pay to use the existing pure passive infrastructures.

- (42) **Market data provided by CMT:** In March 2010, the National Telecommunication Regulatory Authority, CMT provided the Commission with figures concerning the existing telecommunication infrastructure in the Catalonia region. According to such data, one fibre backhaul infrastructure reaches almost all municipalities targeted by the present measure except 13. By contrast, in a number of other municipalities, CMT registers the presence of alternative operators owning fibre infrastructures. However, it is not known whether they offer access to such fibre and, in case, whether the services on offer are actually used by telecom operators to provide connectivity at retail level. This point is relevant to clarify whether access conditions are conducive to competition or there is a market failure. The Spanish authorities finalised their project design on the basis of the data provided by the CMT.
- (43) In particular, the CMT data made it possible to group the municipalities reached by Xarxa Oberta in different categories on the basis of (i) availability of backhaul infrastructure(s) in any given area and (ii) number of operators offering basic broadband retail services.
- (44) **Conditional access to Xarxa Oberta:** In order to achieve their public interest goals while at the same time minimising the distortions of competition and private investments, the Spanish authorities proposed a conditional market access of the Xarxa Oberta which takes into account the competitive conditions on the broadband markets in each target municipality, as detailed below.
- (45) The Spanish authorities designed a conditional system of access to the Xarxa Oberta with the objective (1) to foster NGA deployment in Catalonia by allowing only "NGA last mile infrastructures" within the meaning of the Broadband Guidelines to connect to the new network in approximately 70% of the municipalities; (2) and thereby also to limit the potential distortion of competition on existing operators by not allowing basic broadband infrastructures (such xDSL, wireless, mobile, etc solutions) to connect to the new network where sufficient competition is available at the level of such networks.
- (46) The Spanish authorities will not allow third party operators to connect to the Xarxa Oberta with basic broadband infrastructures where basic broadband services seems to be already offered at competitive conditions or where at least two competing basic broadband infrastructure are already in place – in line with the provisions of the Broadband Guidelines. They argue that such limitations in the use of the Xarxa Oberta network will reduce any potential distortion of competition as regards basic broadband services providers, but at the same time will incentivize NGA network roll-out by contracting a capillar fibre backhaul network in the region.
- (47) On the basis of the above described mapping exercise, the list of targeted areas was finalised and the type of access to Xarxa Oberta per type of area was identified according to the following table.

Table AIII: Municipalities in Catalonia and type of available basic broadband access Services

	<u>Number of municipalities</u>	<u>Infrastructure in place (including dark fibre)</u>	<u>Basic broadband retail offers</u>	<u>NGA infrastructures or plans for the near future</u>	<u>Conditional access to Xarxa Oberta</u>
1	13	None	No	No	All operators can connect to Xarxa Oberta, because no infrastructure is available
2	73	Telefónica	Telefónica	No	All operators can connect to Xarxa Oberta because the areas are not deemed to be competitive
3	29	Telefónica	Telefónica + ULL ³⁴	No	Only 'NGA last mile' infrastructures can connect to Xarxa Oberta
4	64	Telefónica + others	Telefónica	No	Only 'NGA last mile' infrastructures can connect to the Xarxa Oberta
5	81	Telefónica + others	Telefónica + ULL	No	Only 'NGA last mile' infrastructures can connect to Xarxa Oberta
6	17	Telefónica + others	Telefónica + ULL + Cable	No	Only 'NGA last mile' infrastructures can connect to Xarxa Oberta
7	4	Telefónica + others	Telefónica + ULL + Cable	Yes	In the 4 provincial capitals, (Barcelona, Girona, Lleida, Tarragona) the Xarxa Oberta cannot provide commercial wholesale services
Σ	281 municipalities				

(48) At this stage, it was not possible for the Spanish authorities to ascertain whether in municipalities with dark fibre infrastructure available (besides the incumbent's backhaul), such infrastructure is at all on offer to electronic communications operators or if they really demand access to it to serve end-users (this has relevance mainly for municipalities located in category 4 and 5). As a consequence, the categories of the table are at this moment rather conservative and could be updated in the future, subject to the availability of new information concerning the factual situation in the different municipalities. The detailed list of municipalities for each category is listed in the Annex of the present decision.

(49) **Open tender process:** The Spanish authorities intend to select the operator in charge of rollout, management and operation of Xarxa Oberta by means of an open tender procedure. The selected operator will also supply the public administration sites with connectivity services. The regional government will follow a competitive dialogue procedure to select the preferred bidder in compliance with articles 163 to 167 of Spanish Law 30/2007, on 30th October, about Public Sector Contracts and Directive 2004/18/EC.

(50) The tender documents foresee two phases: in Phase I, the public network will be deployed in the 281 municipalities, connecting the 4082

public administration sites and providing wholesale services in those same municipalities. In Phase II, the public network will be extended to cover all the municipalities in Catalonia, i.e. up to 946, thereby connecting the totality of public administration sites in the Region, i.e. 5.843. Only Phase I forms object of the present notification.

- (51) **Award criteria:** The published tender documents consider the most economically advantageous offer will be the selected one in compliance with Article 29 (1) of the Directive 2004/18/EC. The awarding authority set in the tender documents also the award criteria which be used to evaluate the bids. These criteria will apply throughout the competitive dialogue procedure, while being fine-tuned during the process and defined in detail before the final bids are requested, in conformity with the principles of the public procurement legislation. The main award criteria are: coverage, price, level of service, choice of technical solutions, operating plan, marketing plan, warranty services, monitoring methodology.
- (52) **State of play of the tender process:** The call for interest (in the form of a Public- Private dialogue procedure) was published by the Spanish authorities in January 2010: interested parties have been invited to submit their preliminary bids, pending approval by the European Commission. In particular, in the first step of the competitive dialogue, the applicants were informed of the relevant circumstances and of the state of the ongoing State aid notification process and were asked to propose different scenarios to take into account possible modifications to the project occurring during the State aid assessment. Three applicants submitted their proposals. These are currently under assessment by the granting authority to determine which undertakings will be invited to submit the final bids. Such final bids will have to take into account the possible modifications intervened during the course of the State aid procedure before the Commission.
- (53) **Use of existing infrastructure:** The roll-out of Xarxa Oberta is subject to an obligation to reuse, wherever possible, existing infrastructures to avoid unnecessary duplication of infrastructures and to reduce the public funding necessary. As a consequence, first of all, the *Generalitat* will transfer to the selected bidder the infrastructure already deployed and owned by the regional government itself. Secondly, it plans to use all available passive infrastructures, for instance to use ducts throughout the road network and the railway network managed by the *Generalitat*. Thirdly, through agreements with the municipalities within the scope of the project, it is planned to use their infrastructure, particularly ducting and, in some cases, fibre-optic networks for deployment of the Xarxa Oberta urban network. Fourthly, to the extent possible, and subject to agreement with the commercial operators, the Spanish authorities also plan to use the infrastructure of alternative connectivity services providers (typically by renting dark fibre capacity from them).
- (54) **Technology:** The Generalitat considers that the single solution considered adequate for the self-provision of high capacity connectivity services to all public administrations sites with a minimum bandwidth of 100

Mbit/s is to build a fibrebased network. As for the wholesale subproject, the Spanish authorities indicate that the services provided on the wholesale market will be such as to enable the interconnection to the public backhaul network of any possible technology which operators wish to use for their access infrastructure. Backhaul (transport) services are technologically neutral in the sense that they can be used by any wireless, mobile or wire-based operator to connect its access network. Retail operators may provide access services using different technologies, whether based on wireline technologies (copper, HFC cable solutions, passive optical network PON or active point-to-point) or wireless (Wi-Fi, WiMAX, 2G, 3G, 4G/LTE, etc.). Therefore any third party operator, regardless of the type of technology used, can benefit from the measure – subject to the conditional opening as described in Table 1.

- (55) **Wholesale access:** The aim of the Xarxa Oberta, in its "wholesale subproject", is to sell the excess capacity to any third operator wishing to connect its last mile infrastructure according to the modalities highlighted above. Hence, naturally, wholesale access will be provided on non-discriminatory and open access terms. Wholesale services include active access by means of the provision of transport services as well as passive access by providing access to dark fibre renting services. The Spanish authorities also indicated that duct access will be available on the parts of the network owned by the public administration or built by the selected bidder. However, it will not always be possible to impose such obligation on the segments of the network which will be rented – on market terms – from operators of pure passive infrastructures.
- (56) According to the tender documents, the winning bidder will have to establish a new undertaking to build and operate the network. If the winning bidder is also active on the wholesale and the retail market, it will have to ensure its legal, functional and accounting separation of the two businesses in order to avoid any concern of possible anticompetitive exploitation of the advantages created by the management of the Xarxa Oberta. Under no circumstances will the winning bidder be able to give preferential treatment to its retail branch with regard to the use of the Xarxa Oberta.
- (57) **Duration of the measure:** The contract lifetime is expected to be 20 years, although the final duration will be determined in the course of the competitive dialogue, with the possibility to be extended up to 30 years.
- (58) **Monitoring and claw-back mechanism:** The compliance of the selected bidder with the contract will be monitored on a regular basis. Details of the monitoring mechanism will be discussed and agreed at the final stage of the competitive dialogue procedure with the possible bidders. The details of the mechanism will be described in the contract with the beneficiary. The Regional government envisages also a claw back mechanism for the "Xarxa Oberta" project, to avoid any overcompensation to the beneficiary. The calculation of the amount to claw-back will be dependent on the EBITDA for the wholesale subproject and will comprise the whole lifetime of the project. According to the Spanish authorities, the

methodology will allow to take into account not only the operator's revenues but also whether the costs really faced are lower than those estimated in the business plan.

- (59) **Price Benchmarking:** A price benchmarking mechanism is incorporated in the funding agreement. The National Regulatory Authority, CMT will monitor the Xarxa Oberta's compliance with the legislative framework for telecommunications established in Article 6 of the LGT (implemented by Article 5 of Royal Decree 424/2005) once the Xarxa Oberta plans to commence operations.
- (60) The price for wholesale access will be based on average prices for comparable services in more competitive areas. The regulated prices will be in general lower than current prices for long distances (therefore ensuring that consumers benefit from a competitive price and remedying the perceived market failure) while Xarxa Oberta short-distance prices would be less attractive so as not to interfere with the business plans of operators which may have made investments to reach the incumbent operator's centres. The Spanish authorities believe that third party operators will primarily use Xarxa Oberta as the 'middle mile' to connect their (NGA) 'last mile' infrastructures' with their own core network and to lesser extent to use it to provide wholesale terminal leased line services (i.e. dedicated fibre line) exclusively targeted to business users, hence the Spanish authorities argue that the potential crowding out of existing leased line operators will be limited.
- (61) The regional government indicates that whenever a reference offer is not available, wholesale prices and access conditions will be determined by the granting authority but will require the approval of the Spanish NRA, Comisión del Mercado de las Telecomunicaciones (CMT).

V. THE VIEW OF INTERESTED PARTIES

- (62) The Spanish incumbent operator, Telefónica is very critical towards the project. In particular, the operator is concerned by the substantial impact that the wholesale subproject will have on the broadband markets in which Telefónica is active and which may bring significant revenues for the winning bidder. In particular, Telefónica is concerned that:
- (a) The Generalitat's investment involves a rollout of capacity that exceeds by far the needs of connectivity for public administration offices (selfprovision). According to Telefónica's calculations, schools are the most bandwidth intensive public bodies. However, even schools would only require 1% of the total capacity of only 1 fibre, hence with a network featuring 4 fibres, massive extra capacity would be released on the private market throughout the 20 year period.
 - (b) Telefónica asserts that it could provide the necessary broadband services to the public administration for a price about 65% cheaper than

- the foreseen investment by Generalitat but without releasing the ownership of the network at the end of the project
- (c) (c) On the basis of the previous points, Telefónica alleges the existence of aid also for the self-provision services due to over-compensation.
 - (d) They argue that the Generalitat's plan to roll out a parallel backbone network using public funding throughout the entire geographic area of Catalonia is unnecessary since Telefónica's network is already there and no market failure exists.
 - (e) Telefónica doubts the qualification of the Xarxa Oberta as a backhaul network: in its view, the project should be considered also as an access network because the access points will be very close to the end users (for example those in the schools). This would distort competition.
- (63) The Spanish authorities provided their comments on Telefónica's submission.
- (64) First, they argue that Telefónica estimated the extra capacity of the network assuming an access technology that is not suitable for the connectivity of public administration sites and access applications and that properly calculated the excess capacity will not be as sizeable as Telefónica argues. In any case, the Generalitat notes that the decision to lay down 4 fibres per site is perfectly reasonable, since it does not entail excessive additional cost and it belongs to its discretion as public authority.
- (65) Secondly, concerning the self-provision project, the Spanish authorities remark that they are the best placed to assess their own bandwidth requirements and, accordingly, they are free not to take into account in their estimates Telefónica's allegations.
- (66) Thirdly, the Spanish authorities restate that the decision to roll out its own network will allow the public administration to satisfy its needs with a future-proof network solution that will be able to satisfy the continuously growing communication needs of the public authorities. The tender procedure will allow to obtain the best price to roll out this new network. The connectivity fees during 20 years will cover both the provision of services and the deployment of the network, bearing in mind that the assets (i.e. infrastructure, network elements and systems) will be transferred to the Generalitat at the end of the project lifetime without any additional payment. The Spanish authorities argue that they do not act as a market investor, hence it has no relevance whether Telefónica could make an allegedly cheaper offer (without the ownership of the infrastructure); it is the sole discretion of the Spanish authorities to ensure future proof connectivity service to its public administration bodies.
- (67) Fourthly, the Spanish authorities argue that they are also of the opinion that the wholesale subproject entails State aid within the meaning of the TFEU, hence has the potential to distort competition. That is the reason why they duly notified the Xarxa Oberta project to the Commission for State aid clearance.

(68) Other stakeholders commented in particular on the wholesale sub-project. Several operators highlighted the potential pro-competitive gains of the wholesale provision of connectivity services on the commercial market. Most stakeholders see that the market is currently not flexible enough (in terms of pricing and quality of service) to satisfy the connectivity needs of citizens and businesses of Catalonia. However, the undertakings operating existing telecommunication infrastructure highlighted the importance of not crowding out private investments by allowing public authorities to invest in areas in which private operators are already providing comparable services at competitive conditions.

VI. ASSESSMENT OF THE MEASURE: THE SPANISH AUTHORITIES DO NOT ACT LIKE A MARKET INVESTOR

(69) First, it is assessed whether the aid measure is in line with the Market Economy Investments Principle ("MEIP") and accordingly does not constitute State aid within the meaning of the TFEU.

(70) According to the relevant case law and Court jurisprudence – in the absence of a private co-investor - the Commission has to verify whether the Spanish authorities invest in the construction of the Xarxa Oberta on the basis of a feasibility study and a sound business plan – i.e. taking steps which every private investor would have done before undertaking comparable investments.

(71) The Spanish authorities stated that their decision to invest in the Xarxa Oberta project was based on their own estimates of costs and benefits, which did not include a detailed feasibility study or a business plan in the same way as a private investor would have done it. In fact, the Spanish authorities themselves argue that the measure is justified by public interest objectives. In its discretion as a public authority, the Generalitat has decided to procure an advanced network (point-topoint, very high speed fibre connection) for every public administration site in Catalonia and to put this network (the backhaul part of it), once rolled out, at the disposal of private operators to allow them to connect their own last mile infrastructures. This does not reflect the procurement behaviour one can expect from a private operator; rather it resembles a strategic decision driven by the specific choice of the public authority. Moreover, the Spanish authorities claim that public investment from state funds in the targeted municipalities is necessary precisely because market players are not willing to invest in order to deploy an infrastructure similar to the Xarxa Oberta, at least not on similar conditions.

(72) Therefore, the Commission's view is that the Generalitat's action as regards the investment in the network infrastructure is not guided by revenue or profitmaximising behaviour but primarily by the aim of building a region wide infrastructure to its public authorities and to lower entry barriers for alternative operators to boost competitive supply of certain electronic communications services.

- (73) Having established that the measure does not comply with the Market Economy Investments Principle, it is necessary to assess whether the measure constitutes state aid within the meaning of the TFEU.
- (74) According to Article 107 (1) TFEU, “any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market”. It follows that in order for a measure to qualify as State aid, the following cumulative conditions have to be met: 1) the measure has to be granted out of State resources, 2) it has to confer an economic advantage to undertakings, 3) the advantage has to be selective and distort or threaten to distort competition, 4) the measure has to affect trade between Member States.

VII. ASSESSMENT OF THE MEASURE

VII.1. PRESENCE OF AID

State resources

- (75) As explained above in paragraphs (31) to (33), the Xarxa Oberta project is going to be funded through a form of project financing: the tender documents asked the bidders to indicate how much they would request to the Generalitat as monthly payments per each public administration site connected for (at least) 20 years, with a cap of 1.050 € per site. After this period of time, the network will be transferred back to the Generalitat. Hence, the notified measure is financed out of the central budget of the Catalan Regional Government and therefore State resources are involved.
- (76) In addition, as explained above in paragraph (34) the Generalitat will transfer to the winning bidder the existing infrastructure it currently owns. To the extent such infrastructure will be used for the provision of wholesale connectivity services on the private market, additional State resources are involved.
- (77) In State aid broadband cases, aid amounts and aid intensities are usually known only *ex post*, i.e. after the tender process (“gap funding”): the Commission requests aid to be granted through an open tender procedure, which guarantees that it will be the minimum necessary. Hence also for this case it is not crucial to quantify the aid amount in advance.

Economic advantage

- (78) *Selected operators*: The contract for building and managing the public network, as well as providing the communications services to the public administration will be awarded to a company that will be also entitled to use the public network for the provision of wholesale communications services on the private market.

- (79) In particular, funding the rollout of a broadband network in areas in which a private operator would not otherwise invest, implies that the fees paid by the Generalitat to the selected operator will also cover the additional costs needed to invest in such non profitable areas.
- (80) Therefore, the selected operator will receive financial support which will enable it to provide broadband services at conditions not otherwise available on the market. The aid will allow the operator to offer end-to-end services *prima facie* at lower prices than if it had had to bear all costs itself and thus attract more customers than under normal market conditions. The selected operator will also acquire ownership of certain tangible and intangible assets with State funds (e.g. existing portions of infrastructure, equipment, customer relations). In view of the above, an economic advantage will be granted to the selected operator.
- (81) *Third party providers:* The Xarxa Oberta will provide third party operators wholesale broadband services with access to a state of the art, future-proof backhaul infrastructure. This way, third party operators will be granted an economic advantage since they will have access to wholesale capacity made available by State funding, as they will be customers of the selected electronic communication operators. By using such capacity, they can sell advanced broadband services to end customers.
- (82) *End users: regional public administrations.* The Spanish authorities' intention is to rollout a NGA network to connect all the public administration sites under the responsibility of the Generalitat. The sites to be connected include all governmental departments and agencies, sites of the health care administration, primary and higher education institutions, research institutes, museums, libraries and cultural institutes, fire and police service, heritage conservation, environmental protection. As explained above in paragraph (23), the regional government is currently already aggregating the demand of the mentioned public administration bodies and is procuring centrally the connectivity services for all of them.
- (83) The Commission has already accepted in the past that the fact that a public authority builds its own public-sector network to satisfy its needs for Internet connectivity (instead of procuring such services from private operators) does not entail an economic advantage for the beneficiaries since they do not exercise an economic activity. Furthermore, as explained in paragraph (27) above, for the public entities conceivably performing an economic activity (such as health care providers) – thus potentially, recipients of an "advantage" – any compensation received for connectivity services would not be covered by the present decision.
- (84) *Other end users:* The measure aims at improving the provision of existing broadband services to residential and business users in Catalonia. Undertakings in the targeted areas will therefore ultimately benefit from the provision of the new and improved services.

Distortion of competition

- (85) The intervention of the State alters existing market conditions by allowing the provision of enhanced wholesale broadband services by the selected electronic communication operator and third party providers that would not be available under normal market conditions. The measure will alter the conditions of competition between wholesale operators who are likely to use the services offered by Xarxa Oberta in the targeted areas and wholesale operators elsewhere in Spain and the EU.
- (86) The scheme is also selective in that it is addressed to undertakings active only in a specific region and in certain markets for electronic communications services. These selectivity elements also induce a potential distortion of competition.
- (87) Therefore, the fact that an improved broadband service and additional (wholesale) capacity becomes available has the effect of distorting competition.

Effect on trade

- (88) Insofar as the intervention is liable to affect providers of electronic communications services from other Member States, the measure has an effect on trade. The markets for electronic communications services are open to competition between operators and service providers, which generally engage in activities that are subject to trade between Member States. Moreover, the measure has the potential to distort competition between business users located in Spain and those located elsewhere in the European Union.

Conclusion

- (89) The Commission therefore concludes that in so far as Spanish state funds are used to finance the deployment of a backhaul network for wholesale provision of services on the private market, the notified measure "Xarxa Oberta" constitutes State aid within the meaning of Article 107 (1) TFEU as moreover confirmed by the notifying Member State during the notification contacts. Having established that the project involves aid within the meaning of Article 107(1) TFEU to the selected service providers, third party providers and undertakings, it is necessary to consider whether the measure can be found to be compatible with the internal market.

VII.2. ASSESSMENT OF THE MEASURE: COMPATIBILITY

- (90) The Commission has assessed the compatibility of the scheme according to Article 107 (3) (c) TFEU and in the light of the *Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks*. The Broadband Guidelines contain a detailed interpretation of Article 107 (3) (c) TFEU in this area of State aid law. As regards the applicable substantive provisions, the Commission has

essentially analysed the measure in the light of the criteria developed in particular in paragraphs 31-79 of the Broadband Guidelines.

VII.2.1. The balancing test and its application to aid for the broadband network

Deployment

(91) As described in paragraphs 34 and 35 of the Broadband Guidelines, in order to assess whether a measure is compatible under article 107 (3)(c), the Commission balances positive and negative effects of the aid according to the criteria set out in the Guidelines. In applying the balancing test, the Commission will assess the following questions:

- (1) Is the aid measure aimed at a well-defined objective of common interest (i.e. does the proposed aid address a market failure or other objective)?
- (2) Is the aid well designed to deliver the objective of common interest? In particular:
 - (a) Is the aid measure an appropriate instrument?
 - (b) Is there an incentive effect, i.e. does the aid change the behaviour of firms?
 - (c) Is the aid measure proportional, i.e. could the same change in behaviour be obtained with less aid?
- (3) Are the distortions of competition and the effect on trade limited, so that the overall balance is positive?

VII.2.2. Objective of the measure

The aid is in line with the policy of the Union

(92) The importance of full high speed internet coverage of the territories of Member States and the need to encourage joint initiatives of stakeholders has been explicitly identified by the European Council of March 2009: *"the European Council recalled the fundamental role of telecommunications and broadband development in terms of European investment, job creation and overall economic recovery. Taking account of the risks taken by the investing undertakings, efficient investment and innovation in new and enhanced infrastructure should be promoted."*

(93) The Commission defined in its Europe 2020 strategy of 3 March 2010 the Flagship Initiative: "A Digital Agenda for Europe", which has the *"aim to deliver sustainable economic and social benefits from a Digital Single Market based on fast and ultra fast internet and interoperable applications, with broadband access for all by 2013, access for all to much higher internet speeds (30 Mbps or above) by 2020, and 50% or more of European households subscribing to internet connections above 100 Mbps."*

(94) The wholesale subproject of the Xarxa Oberta project has as its main target *"white NGA areas"*, i.e. areas where no NGA broadband coverage is

currently available and where there are no plans by private investors to roll out such infrastructure in the near future of three years. By granting access to the backhaul of the Xarxa Oberta to third party NGA operators, the measure facilitates and encourages investments in NGA (last mile) networks, in line with the objectives of the Broadband Guidelines. As a secondary objective, the Spanish authorities also intend to allow the use of the backhaul of the Xarxa Oberta to bridge the traditional digital divide (i.e. as regards basic broadband) wherever necessary. This concerns specifically traditional "white areas" where no broadband infrastructure is present or problematic "grey areas", in which the presence of one infrastructure does not exclude the existence of a market failure or cohesion problem.

- (95) By extending NGA broadband coverage to areas where private operators have no commercial interest to invest in the near future, the Spanish authorities pursue genuine cohesion and economic development objectives which is in line with the Digital Agenda and Sections 2.3.2. and 3.1 of the Broadband Guidelines.

Aid is the appropriate instrument

- (96) In the situation currently under assessment, due to the economics of NGA networks, the problem of the lack of supply of high speed broadband networks cannot be solved by measures involving demand stimulation or regulatory interventions.
- (97) Demand-side measures in favour of broadband (such as vouchers, tax breaks, awareness-raising measures or demand aggregation) could be an instrument of public intervention. However, these measures do not solve the illustrated problems on the supply side. As regards regulation, despite its crucial role in ensuring competition and supply in the market for electronic communications, evidence shows that in some areas of Catalonia regulation has not fully been able to ensure effective competition in some of the markets for electronic communications and has not led to sufficient investments to bridge the digital divide affecting certain areas. Regulation is, indeed, a necessary, but not a sufficient instrument for the development of broadband services as alternative providers need to combine the use of wholesale products from the incumbent with own network investments which may not be profitable in areas where demand is low.
- (98) In order to ensure the supply of high-speed broadband services to all its citizens, the Regional Government of Catalonia sees no alternative but to grant public aid to the construction of a backhaul network for the provision of NGA services.
- (99) The Commission can agree that, in line with paragraphs 47 and 48 of the Broadband Guidelines, without further public intervention, avoiding the emergence of a new "*digital divide*" between different areas of the country seems not possible, which could lead to the economic exclusion of the local undertakings. Hence in the current situation, State aid is an appropriate instrument to achieve the set objectives.

The aid provides the right incentives to operators

(100) As set out in paragraph 50 of the Broadband Guidelines, regarding the incentive effect of the measure, it needs to be examined whether the broadband network investment concerned would not have been undertaken without any State aid. According to the results of the public consultation and market research referred to above in paragraph (48) and following, in the targeted areas no NGA network investment would take place without public funding, hence the aid produces a change in the investment decisions of the operators. Moreover, by granting access to the spare capacity of the backhaul of the Xarxa Oberta to third party NGA operators, the measure facilitates and encourages investments in NGA (last mile) networks. Therefore, the aid shall provide a direct and appropriate investment incentive for the selected operator and for third party beneficiaries.

VII.2.3. Design of the measure and the need to limit distortions of competition

(101) The Spanish authorities have designed the measure in such a way as to minimise the State aid involved and potential distortions of competition arising from the measure.

Pro-competitive nature of the project

(102) The wholesale provision of services is not aimed to develop an access network but only a transport "*backhaul*" network. Use of the transport network is a necessary input for retail telecommunication operators to provide (high speed and very high speed) access services to the end users. The operator of the new network will connect 281 municipalities and offer access to wholesale products (such as ducts, dark fibre or active access products) on a commercial basis, limited to the extra capacity after serving the needs of the self provision sub-project. Construction of backhaul networks is generally a measure that fosters competition and investment and, for NGA networks, encourages third party operators to rollout last mile infrastructures capable of supplying advanced connectivity services to end-users. Backhaul networks have the potential to stimulate competition on all access technologies, while leaving the bulk of the investments to connect end-users to private operators.

(103) However, backhaul networks are "hybrid networks" in the sense that they are able to sustain both basic and NGA types of networks: it is the (investment) choice of the telecommunication operators what type of 'last mile' infrastructure they wish to connect to the backhaul network. In particular, operators could decide to use ADSL or wireless solutions (i.e. basic broadband infrastructures), but they could also opt for rolling out, for example, an FTTH architecture (i.e. an NGA infrastructure).

(104) Hence from competition point of view, the possible distortion of competition

resulting from the deployment of subsidised backhaul networks shall be assessed on two levels: (1) the level of basic broadband networks and (2) the level of NGA networks in line with the distinction made in the Broadband Guidelines.

(105) With respect to (1), the measure could cause distortions of competition in those municipalities in which market forces seem to work adequately to provide basic broadband services to citizens. In these areas, public intervention would not be justified, since it would not address a market failure (as competitive broadband providers exist), it would not bring any significant benefits for the targeted areas (as citizens would receive the same level of services), state aid would not have any incentive effect and it could crowd out private investments. By contrast, in municipalities where a market failure exists with regards to basic broadband, the provision of subsidised backhaul services has a pro-competitive character.

(106) As regards point (2), i.e. concerning NGA networks, according to the information submitted by the Spanish authorities, almost the whole of Catalonia (except the four provincial capitals Barcelona, Girona, Lleida and Tarragona,) has to be considered a "white NGA area": even where the incumbent's backhaul infrastructure is present, the access infrastructure is not yet upgraded nor will it be in the next three years (as no "credible investment plans" have been reported in the public consultation within the meaning of paragraph 68 of the Broadband Guidelines).

The system of conditional market access to Xarxa Oberta

(107) To alleviate these different concerns, the Spanish authorities have proposed a system of conditional market access to Xarxa Oberta, depending on the existing market situation in the various municipalities, as explained above in Table 1.

1. "NGA white" and traditional "white areas"

(108) As showed in Table 1 above, there are 13 municipalities in which there is no backhaul infrastructure at all (Category 1). These areas are "white" also from the perspective of basic broadband, hence there is no need to impose restrictions on the type of last mile infrastructures allowed to use Xarxa Oberta's excess capacity, provided that the conditions indicated in paragraph 51 of the Broadband Guidelines are respected (see below in paragraph (124) and following).

2. "NGA white" and traditional "grey areas"

(109) Category 2 comprises 73 municipalities which are only served by the incumbent, not only in the backhaul but also in the access segment. These areas are "grey" from the perspective of basic broadband, but the Spanish authorities demonstrated that the conditions laid down in paragraph 46 of the Broadband Guidelines are fulfilled.

- (110) In target areas the provision of a broadband infrastructure is still a *de facto* monopoly only provided by Telefónica. The Spanish authorities provided evidence that (i) no affordable or adequate services are offered to satisfy the needs of citizens or business users and that (ii) there are no less distortive measures available (including *ex ante* regulation) to reach the same goals.
- (111) For the purpose of establishing the above, the Spanish authorities provided evidence that:
- (a) the overall market conditions are not adequate, by looking, *inter alia*, into the level of current broadband prices, the type of services offered to endusers (residential and business users) and the conditions attached thereto as described in section III.2. The Spanish authorities explained indeed that the price/quality levels offered on the existing infrastructure are not adequate. In particular, the Spanish authorities explained that where high-capacity wholesale leased lines of the incumbent are available in towns of Category 2, these services remain expensive despite the fact that prices and access conditions are subject to regulation and no retail operator is present other than the incumbent. As leased line prices depend on distance, due to the remoteness of the municipalities from the network connection points, prices are considerably higher than in urban and profitable areas, such as Barcelona.
 - (b) access conditions are not conducive to effective competition; and (c) the overall entry barriers preclude potential entry of other electronic communication operators which is evidenced by the lack of third party operators using the network (for instance, ULL operators) in the target areas;
 - (c) any measures taken or remedies imposed by the competent national regulatory or competition authority with regard to the existing network operator have not been able to overcome such problems. For instance, according to the Spanish authorities, even if regulation may have been successful in establishing a competing offer of broadband services, the geographical remoteness and demand characteristics in the areas of Category 2 still prevent the achievement of supply conditions similar to those prevailing in urban areas.
- (112) Hence although a broadband infrastructure exists on the target areas, the evidence provided by the Spanish authorities suggests that a market failure exists. Accordingly, there is no need to impose restrictions on the type of last mile infrastructures allowed to use Xarxa Oberta's excess capacity in the municipalities belonging to category 2, provided that the conditions indicated in paragraph 51 of the Broadband Guidelines are respected (see below in paragraph (124) and following).
- (113) For all other targeted municipalities of Catalonia, the Spanish authorities will allow third operators to connect to Xarxa Oberta only if they deploy NGA

capable 'last mile' infrastructures (except in the four provincial capitals). Those municipalities can be considered 'NGA white areas' where there are no existing NGA infrastructures, no NGA services are currently offered to end users and there are no plans for investment in NGA in the near future of three years. However, in terms of basic broadband networks, on the basis of the available data sufficient competition seems to exist (i.e. traditional "black" areas or unproblematic "grey" areas).

(114) In particular, as far as Category 3 is concerned, the data show the presence of only one infrastructure at the wholesale level, but there are operators alternative to the incumbent active on the retail market offering basic broadband services. This fact suggests that, although the area is "grey" (for traditional broadband), it is not problematic as Category 2 above: a competitive retail market could ostensibly develop due to ULL operators gaining access to the incumbent's network. In presence of the mentioned factors and lacking evidence supporting the existence of a market failure, the conditions of paragraph 46 of the Broadband Guidelines cannot be considered fulfilled and the areas in question can be considered competitive from the point of view of basic broadband.

(115) With respect to the conditions laid down in paragraph 73 of the Broadband Guidelines concerning "white NGA areas" which are "grey" from the perspective of basic broadband, the Spanish authorities proved that (a) the broadband services provided over the existing networks are not sufficient to satisfy the continuously growing needs of citizens and business users in the areas in question and commercial operators do not have sufficient commercial incentives to upgrade the existing networks and (b) there are no less distortive means (including ex ante regulation) to reach the stated goals as described in section III.2 of the current decision.

(116) Accordingly, in the municipalities belonging to category 3, Xarxa Oberta can be used to obtain backhauling only by those third party operators that are investing in *NGA last mile infrastructures* (as described in footnote 32) – but not by operators wishing to obtain backhaul services from Xarxa Oberta for their *basic broadband* infrastructures (for instance, adsl, basic cable, wireless or mobile solutions).

3. "NGA white" and traditional "black areas"

(117) As regards Category 4, there appear to be more than one wholesale infrastructure, i.e. backhaul and other (possibly "pure") passive infrastructures, although only Telefónica is offering broadband services at retail level. Even if at this stage it is not known whether such "other" infrastructures are available for access by third party operators and adequate to the provision of retail broadband services by alternative providers, there is not sufficient proof to exclude it either.

(118) In Category 5 municipalities are listed in which not only there appear to be several wholesale infrastructures, but also a competitive retail market due to the presence of ULL operators. In absence of evidence to the contrary, these areas as well as those of Category 4 could be considered

as "black" from the point of view of traditional broadband and therefore, in line with paragraph 43 of the Broadband Guidelines, State aid cannot be allowed.

(119) Category 6 comprises 17 municipalities in which there are at least two backhaul infrastructures (besides "other" passive infrastructures) and a competitive retail market not only with the presence ULL operators accessing the network of the incumbent but with also an alternative cable infrastructure. These municipalities also constitute black areas from the point of view of traditional broadband.

(120) The Spanish authorities contend that the areas belonging to categories 4, 5 and 6 are "white NGA areas" and hence submitted information to prove that the conditions laid down in paragraphs 75 and 78 of the Broadband Guidelines are fulfilled (as these areas are traditional "black areas"). In particular, the Spanish authorities demonstrated (as described in detail in section III.2 of the current decision) that:

- (a) the overall market conditions are not adequate: there is no provision of NGA services in any of the areas belonging to the three categories (as evidenced by the public consultation conducted by the Spanish authorities, see paragraph (48)) and demand for new services cannot be met by existing networks;
- (b) since no NGA network exists, even in presence of regulation imposed by the NRA, network access cannot be conducive to effective competition in NGA;
- (c) due to the geographical or competitive situation of the areas in question, there are significant entry barriers precluding potential entry by new NGA network investors;
- (d) measures and remedies imposed by the national regulatory authority cannot be able to overcome the problems, in the absence of investments plans;
- (e) existing basic broadband infrastructure operators are not proceeding to invest in upgrading their broadband infrastructures within the next three years to provide higher speeds in response to users' demands.

(121) Hence although several broadband infrastructures exists in the municipalities belonging to category 4 to 6, according to the evidence provided by the Spanish authorities, no operator has plausible commercial plan to upgrade its infrastructure to NGA network in the near future of 3 years. Concerning basic broadband services, based on the data provided by CMT, it seems that these areas are served by at least 2 competing infrastructures, hence there is no evidence that these services are not offered at competitive conditions.

(122) Accordingly, in the municipalities belonging to categories 4, 5 and 6, Xarxa Oberta can be used to obtain backhauling only by those third party operators that are investing in *NGA last mile infrastructures* (as described in footnote 32) – but not by operators wishing to obtain backhaul services from Xarxa Oberta for their *basic broadband* infrastructures (for instance, adsl, basic cable, wireless or mobile solutions).

4. "Grey or black NGA" and traditional "black areas"

(123) On the basis of the available information, the 4 provincial capitals of category 7 (namely Barcelona, Girona, Lleida and Tarragona) can be considered to be traditional "black" areas and "grey or black NGA" areas: as also acknowledged by the Spanish authorities, in these four cities most likely NGA investments will take place in the near future in the meaning of the *Broadband Guidelines*. As a result, with the objective to limit any possible crowding out of future investment plans of commercial operators, Xarxa Oberta cannot be used to offer commercial wholesale services in these four municipalities.

The other proportionality conditions of the Broadband Guidelines

(124) As set out in paragraphs 51 and 79 of the Broadband Guidelines, in assessing the proportional character of the notified measure in "white NGA areas" (in the current case, for all target areas from category 1 to category 6) a number of conditions has to be met in order to minimise the State aid involved and the potential distortions of competition.

(125) **Market research and consultation:** As set out in detail in paragraph (36) and following, the Spanish authorities have undertaken an analysis of the existing broadband infrastructure in order to identify the areas where State intervention is necessary. A public consultation has been conducted as described above in paragraph (48) and following. All the relevant stakeholders have had the opportunity to submit their views and the regulatory authority's opinion has been gathered. This way, the Spanish authorities ensure that public funds are used only in areas where there are no plausible private investment plans to build commercially based high speed or very high-speed (NGA) networks.

(126) Doubts on the projects have been raised by the incumbent operator Telefónica, as highlighted above in paragraph (62). As far as the decision to rollout a new network for self-provision is concerned, the Commission is of the opinion that it is in the discretion of Spain and its public authorities to assess their internal needs and evaluate the best way to serve its citizens, provided that their behaviour does not prejudice to an unacceptable extent the functioning of the market, which is assessed below.

(127) As far as the wholesale sub-project is concerned, Telefónica is right that the measure will distort competition and shall be subject to state aid assessment. To the extent NGA last mile infrastructures will be allowed to be connected to the Xarxa Oberta where existing basic broadband services

are available, the conditional access delineated in Table 1 takes into account the presence of (basic broadband) infrastructure already rolled out and of investments already realised, but considers also the evidence of the existence of certain market failures presented by the Spanish authorities.

- (128) In addition, according to paragraph 67 of the Broadband Guidelines, at present, some advanced basic broadband networks (for instance ADSL 2+) can, up to a certain point, also support some of the types of broadband services that in the near future are likely to be offered over NGA networks (such as basic triple play services). However, and without prejudice to the imposition of ex-ante regulation, it should be noted that novel products or services which are not substitutable from both demand and supply side perspectives may emerge and will require broadband speeds in excess of the upper physical limits of basic broadband infrastructure. Hence, such conditional access will ensure that distortion of competition to existing basic broadband infrastructures will be in line with the provisions of the Broadband Guidelines.
- (129) Furthermore, no operator (including Telefónica), in the context of the public consultation, has put forward the existence of NGA investment plans for the near future for the municipalities belonging to categories 1 to 6. Thus, the Commission considers that the system of conditional access above delineated allows to exploit the pro-competitive aspects of the present measure while minimising the negative impact on competition and investment.
- (130) **Open tender procedure:** To minimise the amount of aid involved, the Spanish authorities run a selection procedure in line with the principles of openness, competition and transparency of the national and EU procurement rules, to select the undertaking for the construction and the management of the network. Details of the procedure and its outcome are described above in paragraph (49) and following. This procedure has the effect of maximising the effect of the aid provided while minimising any potential advantage granted for the selected operator. The Spanish authorities designed the selection procedure so as to choose the most economically advantageous offer among those presented by the operators, as detailed above in paragraph (49) and following. The awarding authority specified in advance the relative weighting, which it will give to each of the qualitative criteria chosen. The system is designed in such a way as to ensure that the bidder requesting the lower amount of aid will be awarded the project, in line with the provision of the Broadband Guidelines and in line with the principles of the public procurement legislation.
- (131) The measure prevents a distortion of competition which could arise from a conflict of interest if the selected network operator provided access to wholesale capacity at the upstream level while at the same time competing downstream on the retail market. By being excluded from entering the downstream market, the operator will have no strategic incentive to deny certain retail companies access to its wholesale capacity.

- (132) **Technological neutrality:** At the current state of technological development, as acknowledged in paragraph 53 of the Broadband Guidelines, only optical fibre can provide the backhaul capacity necessary to provide NGA retail services. On the other hand, as regards the provision of retail broadband services to end users, the design of the measure under assessment does not favour any particular technology or network platform, leaving it to commercial operators to come up with the most appropriate technological solutions to provide retail broadband services to end users. Therefore any third party operator, regardless of the type of technology used, can benefit from the measure in line with the conditions detailed in Table 1. It also has to be highlighted that the definition of NGA last mile infrastructures (which is explained in footnote 32) might change in line with the forthcoming revision(s) of the Broadband Guidelines.
- (133) **Use of existing infrastructures:** The Spanish authorities have designed the measure with the objective to minimize the impact of the new network on the market and on the investment plans of existing electronic communication operators. Wherever possible, the new network will use existing infrastructure, whether owned or leased. This way, the Spanish authorities avoid the unnecessary and wasteful duplication of existing networks and minimise the overall costs of the project. In particular, the infrastructure in the ownership of the Generalitat will be given in use to the selected operator, as explained in paragraph (53) and following.
- (134) **Wholesale access:** The selected operator will offer wholesale services and access to the subsidised network to other operators in an open, transparent and non-discriminatory manner. This will represent in fact the core business model of the winning bidder, due to the obligation of vertical separation with the retail business.
The access obligations will be supervised by CMT.
- (135) **Price benchmarking:** A price benchmarking mechanism is incorporated in the funding agreement. In line with the provision of the Broadband Guidelines, the price for wholesale access will be based on average prices for comparable services in more competitive areas and whenever a reference offer is not available, wholesale prices and access conditions will be approved by the Spanish NRA (CMT), as detailed in paragraphs (59) and (60).
- (136) **Monitoring and claw-back mechanism to avoid over-compensation:** The project will be examined on a regular basis and the monitoring mechanisms implemented will ensure that if the beneficiary fails to comply with the rules, the granting authorities will be in the position to recover the aid granted. By ensuring that any extra profit generated through the operation of the networks will be clawed back as explained in paragraph (57), the Spanish authorities ensure that the recipient of the aid will not benefit from overcompensation and will minimise *ex post* and retroactively the amount of aid deemed initially to have been necessary.

(137) **Additional conditions for NGA networks:** concerning the conditions laid down in paragraph 79 of the Broadband Guidelines for the authorisation of aid measures to NGA networks, the Spanish authorities proved the following:

(a) *Effective wholesale access:* under the current scheme the access obligations imposed on the chosen operator include effective access to both passive (such as ducts, dark fibre) and active infrastructure, as detailed in paragraph (55), without prejudice to any similar regulatory obligations that may be imposed by the NRA in the specific market concerned in order to foster effective competition.

(b) *Role of the NRA:* In the case at hand, the Spanish regulatory authority CMT has been consulted on the project and has provided input necessary to finalise the mapping of the targeted areas. In the phases of implementation of the Xarxa Oberta project, CMT will have the competence to supervise compliance with the agreed access conditions and will approve access tariffs whenever necessary.

(c) *Effective and full unbundling:* The NGA network architecture that will benefit from State aid will support effective and full unbundling and satisfy all different types of network access that operators may seek (including access to ducts, fibre and bitstream) and supports both "point-to-point" and "point-to-multipoint" topologies.

VII.2.4. Conclusion

(138) The Commission concludes that the Xarxa Oberta project meets the compatibility criteria set out in the Broadband Guidelines are met, hence the aid involved in the notified measure is compatible with Article 107(3)(c) TFEU.

(139) In view of the duration of the scheme, the Commission would like to draw the Spanish authorities' attention to future revisions of the Broadband Guidelines, which might make appropriate amendments to the scheme necessary.


VIII. DECISION

On the basis of the foregoing assessment, the Commission has accordingly decided that the measure "*Optical fibre Catalonia (Xarxa Oberta)*" is compatible with Article 107(3)(c) TFEU.

The Spanish authorities are reminded that, pursuant to Article 108(3) TFEU, they are obliged to inform the Commission of any plan to extend or amend the measure.

ANNEX IV. Statistics of the City of Barcelona

Table AIV1. Statistics of the city of Barcelona

 Ajuntament de Barcelona

ESTADÍSTICA

Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos desagregats) > Any 2009



1. Tipologia dels locals cadastrals. Usos desagregats. 2009

1.2. Nombre de locals cadastrals pels 73 barris

Dte.	Barris	Usos dels locals cadastrals												Altres Usos
		TOTAL LOCALS CADASTRALS	Habitatge	Aparcaments	Comerç	Indústria	Oficines	Ensenyament	Sanitat	Hostaleria	Esportiu	Religiós	Espectacles	
BARCELONA		1.343.737	805.739	325.750	84.988	70.872	30.888	7.805	3.821	6.958	2.565	2.031	821	1.519
1	1. el Raval	32.464	23.342	2.656	2.622	1.669	866	226	40	843	23	68	79	30
1	2. el Barri Gòtic	17.255	10.405	563	1.709	2.030	1.246	230	28	817	5	71	28	123
1	3. la Barceloneta	11.627	9.172	1.444	435	76	149	54	57	197	18	19	0	6
1	4. Sant Pere, Santa Caterina i la Ribera	20.051	14.403	1.041	2.074	1.076	925	120	21	243	5	49	26	68
2	5. el Fort Pienc	25.495	15.432	7.261	1.002	953	626	60	17	89	11	17	15	12
2	6. la Sagrada Família	43.542	27.152	11.291	2.755	1.326	764	42	70	96	6	9	9	22
2	7. la Dreta de l'Eixample	51.983	26.071	9.956	4.825	2.863	6.405	423	206	758	44	188	97	147
2	8. l'Antiga Esquerra de l'Eixample	41.631	24.134	9.247	3.283	1.990	1.899	242	140	404	36	52	46	158
2	9. la Nova Esquerra de l'Eixample	53.033	29.723	16.591	2.610	1.646	1.834	169	129	190	34	42	38	27
2	10. Sant Antoni	33.660	20.106	7.806	3.054	1.479	821	95	63	122	27	24	37	26
3	11. el Poble Sec - Parc Montjuïc	26.969	19.187	3.196	1.939	1.591	343	138	39	250	119	27	38	102
3	12. la Marina del Prat Vermell - Zona Franca	5.753	904	1.122	1.041	2.106	483	32	6	18	8	1	0	32
3	13. la Marina de Port	21.421	12.683	6.587	1.051	782	146	82	22	9	39	8	0	12
3	14. la Font de la Guatlla	8.028	4.875	2.330	401	317	44	31	1	16	6	2	1	4
3	15. Hostafrancs	14.427	7.932	3.717	1.453	844	214	108	15	102	19	16	7	0
3	16. la Bordeta	14.059	8.492	3.135	626	647	240	58	17	13	3	7	0	21
3	17. Sants - Badal	18.627	11.505	5.099	1.098	942	166	33	33	10	15	14	2	10
3	18. Sants	35.609	20.940	8.669	3.075	2.158	369	184	81	124	33	19	18	19
4	19. les Corts	47.937	22.696	17.974	2.962	2.029	1.708	138	73	185	59	31	19	33
4	20. la Maternitat i Sant Ramon	20.997	11.538	6.545	815	1.003	408	287	31	192	153	16	1	8
4	21. Pedralbes	12.234	5.723	4.793	237	297	324	418	16	117	149	34	5	121
5	22. Valldorera, el Tibidabo i les Planes	4.543	3.067	871	160	386	13	80	21	27	76	37	11	14
5	23. Sarrià	24.248	12.365	7.924	1.220	1.186	287	321	134	104	545	137	1	24
5	24. les Tres Torres	17.955	6.931	8.032	486	1.078	371	75	270	36	31	44	1	0
5	25. Sant Gervasi - la Bonanova	25.213	12.189	9.042	1.200	972	498	407	429	130	198	109	14	25
5	26. Sant Gervasi - Galvany	51.219	24.999	14.998	3.886	2.712	3.218	307	353	366	68	141	79	92
5	27. el Poble i el Farró	30.043	15.968	10.154	1.374	1.461	637	161	108	83	45	35	14	3
6	28. Vallcarca i els Penitents	14.304	8.650	4.094	576	558	93	95	110	27	58	36	2	5
6	29. el Coll	6.112	3.820	1.649	262	261	61	29	5	10	9	5	0	1
6	30. la Salut	11.664	6.843	3.301	547	469	113	79	198	29	31	49	3	2
6	31. la Vila de Gràcia	46.135	30.957	6.956	3.678	2.761	965	229	81	207	50	148	81	22
6	32. el Camp d'en Grassot i Gràcia Nova	28.589	18.047	6.429	1.486	1.956	413	73	32	21	26	31	5	70
7	33. el Baix Guinardó	18.586	12.338	4.100	1.032	656	168	137	62	33	17	21	6	16
7	34. Can Baró	6.535	4.780	886	340	425	32	39	17	8	7	0	0	1
7	35. el Guinardó	28.826	18.305	6.247	2.016	1.541	221	175	182	61	31	16	25	6
7	36. la Font d'en Fargues	8.599	5.229	2.370	209	484	42	148	33	13	51	14	4	2
7	37. el Carmel	22.976	15.347	4.602	1.418	1.323	77	105	35	19	20	23	5	2
7	38. la Teixonera	9.085	5.661	2.212	629	504	34	25	3	8	2	6	0	1
7	39. Sant Genís dels Agudells	4.578	3.501	639	176	124	15	49	22	5	17	20	10	0
7	40. Montbau	3.649	2.553	143	155	500	21	104	108	15	22	28	0	0
7	41. la Vall d'Hebron	4.364	3.724	164	69	274	2	21	2	29	26	49	0	4
7	42. la Ciutat	468	334	23	34	67	0	4	3	0	0	3	0	0
7	43. Horta	21.938	13.427	5.553	1.414	1.001	92	143	91	44	73	82	14	4
8	44. Vilapicina i la Torre Llobeta	19.393	12.066	4.917	1.241	779	129	158	22	38	7	17	5	14
8	45. Porta	17.705	11.201	4.649	992	576	113	80	6	38	13	15	10	12
8	46. el Turó de la Peira	9.137	6.829	1.052	771	367	23	54	11	6	9	14	0	1
8	47. Can Peguera	1.379	1.000	297	41	18	0	21	0	0	0	2	0	0
8	48. la Guineueta	10.630	6.793	2.702	591	280	52	95	27	20	28	11	0	31
8	49. Canyelles	3.590	2.921	324	208	72	37	14	3	2	7	1	0	1
8	50. les Roquetes	9.585	6.962	1.171	652	673	20	62	3	21	19	2	0	0
8	51. Verdun	8.357	5.944	1.492	621	193	28	65	0	2	4	7	0	1
8	52. la Prosperitat	18.573	12.464	4.073	981	861	56	79	8	12	20	8	9	2
8	53. la Trinitat Nova	4.325	3.679	288	230	75	7	22	9	4	5	6	0	0
8	54. Torre Baró	1.899	1.382	145	116	209	0	27	2	4	9	1	0	4
8	55. Ciutat Meridiana	4.615	3.968	123	287	158	24	31	7	6	3	8	0	0
8	56. Vallbona	1.520	885	360	113	114	0	6	0	6	7	1	0	28
8	57. la Trinitat Vella	6.208	3.996	1.326	401	358	41	36	2	10	5	10	0	23
8	58. Baró de Viver	1.810	1.111	459	101	104	3	27	0	0	0	2	0	3
8	59. el Bon Pastor	10.229	5.307	1.855	790	1.868	334	30	11	14	6	6	0	8
9	60. Sant Andreu	45.158	27.398	11.702	2.839	2.544	228	185	62	71	56	47	11	15
9	61. la Sagrera	21.830	13.014	5.913	1.349	1.040	268	136	58	14	21	9	0	8
9	62. el Congrés i els Indians	10.342	6.917	1.896	774	471	74	115	29	32	8	20	0	6
9	63. Navas	15.701	9.964	4.089	872	511	133	57	12	28	6	6	16	7
10	64. el Camp de l'Arpa del Clot	29.876	19.768	6.668	1.316	1.447	240	96	15	264	14	21	8	19
10	65. el Clot	20.200	12.237	5.765	1.319	613	151	59	17	18	8	3	5	5
10	66. el Parc i la Llacuna del Poblenou	13.793	6.434	3.494	1.034	2.365	396	17	7	28	6	4	0	8
10	67. la Vila Olímpica del Poblenou	12.452	4.670	6.225	379	933	143	19	11	35	20	4	0	13
10	68. el Poblenou	24.765	15.446	8.001	1.572	1.379	220	41	43	27	10	18	3	5
10	69. Diagonal Mar i el Front Marítim del Poblenou	11.550	5.160	5.534	423	169	148	3	0	96	6	0	10	1
10	70. el Besòs i el Maresme	11.810	9.500	813	714	469	169	64	16	23	11	13	3	15
10	71. Provençals del Poblenou	15.188	8.554	4.517	464	1.375	206	28	10	21	1	4	0	8
10	72. Sant Martí de Provençals	17.397	11.703	3.326	992	1.014	120	142	21	35	30	13	0	1
10	73. la Verneda i la Pau	18.689	13.116	2.762	1.151	1.414	132	80	5	3	11	10	0	5

Departament d'Estadística. Ajuntament de Barcelona

Font: Direcció General del Catastro. Ministerio de Economía y Hacienda.

Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia



Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos desagregats) > Any 2009

Table AIV2. Statistics of the city of Barcelona

Ajuntament de Barcelona		ESTADÍSTICA									
Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els habitatges cadastrals > Nombre de locals habitatge segons superfície > Any 2009											
←											
1. Nombre de locals habitatge segons superfície. 2009											
1.1. Superfície per districtes											
Districte	TOTAL LOCALS HABITATGE	Fins a 30 m ²	31- 60 m ²	61- 90 m ²	91- 120 m ²	121- 150 m ²	151- 210 m ²	211- 250 m ²	Més de 250 m ²	NC	m ²
BARCELONA	805.739	27.112	219.245	366.352	123.466	35.609	24.648	4.991	4.293	33	
1. Ciutat Vella	57.322	4.808	25.549	15.157	6.308	2.951	1.744	396	400	11	
2. Eixample	142.618	2.672	24.364	61.922	33.635	10.304	7.111	1.489	1.112	9	
3. Sants-Montjuïc	86.418	2.535	26.398	45.725	10.417	1.047	241	26	25	4	
4. Les Corts	39.957	832	6.243	16.514	10.039	3.390	2.254	408	272	5	
5. Sarrià-St Gervasi	75.519	2.527	11.843	19.143	16.321	10.367	10.878	2.350	2.088	2	
6. Gràcia	68.317	2.973	19.357	31.353	10.298	2.684	1.274	203	175	0	
7. Horta-Guinardó	85.199	4.671	28.885	41.720	8.009	1.468	348	45	61	2	
8. Nou Barris	76.094	2.098	31.461	37.090	5.029	304	80	10	22	0	
9. Sant Andreu	67.707	1.868	18.896	37.631	8.477	689	126	13	7	0	
10. Sant Martí	106.588	2.130	26.249	60.097	14.923	2.415	582	51	131	0	

Departament d'Estadística. Ajuntament de Barcelona

Font: Dirección General del Catastro. Ministerio de Economía y Hacienda.
 Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia



Table AIV3. Statistics of the city of Barcelona

Ajuntament de Barcelona		ESTADÍSTICA										
Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els habitatges cadastrals > Nombre de locals habitatge segons antiguitat > Any 2009												
←												
1. Nombre de locals habitatge segons anys de construcció. 2009												
1.1. Antiguitat per districtes												
Districte	TOTAL LOCALS HABITATGE	Abans de 1901	1901- 1940	1941- 1950	1951- 1960	1961- 1970	1971- 1980	1981- 1990	1991- 2000	2001- 2004	A partir 2004	NC
BARCELONA	805.739	84.787	124.733	25.108	79.921	208.971	171.673	39.103	42.859	19.384	9.047	153
1. Ciutat Vella	57.322	34.241	11.616	1.501	1.296	2.444	1.546	1.190	2.592	592	294	10
2. Eixample	142.618	23.517	41.197	5.065	9.091	24.426	25.144	6.859	4.922	1.491	892	14
3. Sants-Montjuïc	86.418	7.829	19.281	1.751	5.648	18.049	20.016	5.560	5.368	2.030	864	22
4. Les Corts	39.957	266	2.627	989	3.737	10.860	15.534	3.961	1.397	285	298	3
5. Sarrià-St Gervasi	75.519	1.722	10.063	6.661	10.304	20.396	17.463	4.196	3.087	1.205	425	7
6. Gràcia	68.317	8.107	15.495	2.773	5.468	14.657	15.465	2.627	2.428	863	436	10
7. Horta-Guinardó	85.199	1.018	5.409	3.034	12.482	32.927	18.621	3.706	5.448	1.620	864	70
8. Nou Barris	76.094	261	1.724	838	13.383	34.480	18.136	2.021	2.656	1.527	1.068	0
9. Sant Andreu	67.707	2.502	4.905	1.274	6.998	21.068	18.087	3.446	4.515	3.648	1.250	15
10. Sant Martí	106.588	5.324	12.416	1.222	11.514	29.664	21.671	5.538	10.448	6.133	2.656	2


Departament d'Estadística. Ajuntament de Barcelona

Font: Dirección General del Catastro. Ministerio de Economía y Hacienda.
 Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia




[Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els habitatges cadastrals > Nombre de locals habitatge segons antiguitat > Any 2009](#)

Table AIV4. Statistics of the city of Barcelona

 **Ajuntament de Barcelona**

ESTADÍSTICA

Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos desagregats) > Any 2009




1. Tipologia dels locals cadastrals. Usos desagregats. 2009

1.1. Nombre de locals cadastrals per districtes


Districte	Usos dels locals cadastrals												
	TOTAL LOCALS CADASTRALS	Habitatge	Aparcaments	Comerç	Indústria	Oficines	Ensenyament	Sanitat	Hostaleria	Esportiu	Religiós	Espectacles	Altres usos
Barcelona	1.343.737	805.739	325.750	84.988	70.872	30.868	7.805	3.821	6.988	2.565	2.031	821	1.519
1. Ciutat Vella	81.397	57.322	5.704	6.840	4.851	3.186	630	146	2.100	51	207	133	227
2. Eixample	249.344	142.618	62.152	17.529	10.257	12.349	1.031	625	1.659	158	332	242	392
3. Sants-Montjuïc	146.093	86.418	34.455	10.884	9.287	2.025	666	214	542	242	94	66	200
4. Les Corts	81.168	39.957	29.312	4.034	3.329	2.440	843	120	504	361	81	25	162
5. Sarrià-St Gervasi	152.621	75.519	50.821	8.326	7.795	5.024	1.331	1.315	746	963	503	120	158
6. Gràcia	108.804	68.317	22.429	6.549	6.005	1.645	505	428	294	174	269	91	100
7. Horta-Guinardó	129.604	85.199	26.939	7.492	6.899	704	950	558	235	266	262	64	36
8. Nou Barris	110.708	76.094	21.593	6.844	4.375	499	714	98	159	131	93	24	94
9. Sant Andreu	111.278	67.707	27.240	7.126	6.896	1.081	586	174	169	102	100	27	70
10. Sant Martí	175.720	106.588	45.105	9.364	11.178	1.925	549	145	550	117	90	29	80

Departament d'Estadística. Ajuntament de Barcelona
 Font: Dirección General del Catastro. Ministerio de Economía y Hacienda.
 Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia




Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos desagregats) > Any 2009

Table AIV5. Statistics of the city of Barcelona

 **Ajuntament de Barcelona**

ESTADÍSTICA

Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos agregats) > Any 2009




1. Tipologia dels locals cadastrals. Any 2009

1.1. Tipologia per districtes

Districte	TOTAL LOCALS CADASTRALS	Nombre de locals habitatge	Nombre de locals aparcaments	Altres locals
Barcelona	1.343.737	805.739	325.750	212.248
1. Ciutat Vella	81.397	57.322	5.704	18.371
2. Eixample	249.344	142.618	62.152	44.574
3. Sants-Montjuïc	146.093	86.418	34.455	24.220
4. Les Corts	81.168	39.957	29.312	11.899
5. Sarrià-St Gervasi	152.621	75.519	50.821	26.281
6. Gràcia	108.804	68.317	22.429	16.058
7. Horta-Guinardó	129.604	85.199	26.939	17.466
8. Nou Barris	110.708	76.094	21.593	13.021
9. Sant Andreu	111.278	67.707	27.240	16.331
10. Sant Martí	175.720	106.588	45.105	24.027

Departament d'Estadística. Ajuntament de Barcelona
 Font: Dirección General del Catastro. Ministerio de Economía y Hacienda.
 Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia




Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Tipologia dels locals (usos agregats) > Any 2009

Table AIV6. Statistics of the city of Barcelona


Ajuntament de Barcelona		ESTADÍSTICA												
Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Superfície dels locals > Any 2009														
1. Superfície dels locals cadastrals segons usos desagregats. 2009														
1.2. Superfície dels locals cadastrals pels 73 barris														
Dte.	Barri	SUPERFÍCIE TOTAL (m ²)	Superfície dels locals cadastrals segons usos											
			Habitatge	Aparcaments	Comerc	Indústria	Ofícines	Ensenyament	Sanitat	Hostalera	Esporitiu	Religiós	Espectacles	Altres usos
BARCELONA														
		110.130.327	62.076.757	11.344.650	8.200.518	11.330.170	5.990.442	3.241.050	1.559.564	1.999.734	1.423.516	611.673	379.911	1.172.542
1	el Raval	2.705.870	1.546.988	160.328	209.740	158.295	139.212	169.324	14.885	202.307	11.446	29.450	54.312	11.583
2	el Barri Gòtic	2.114.277	933.865	85.002	218.989	175.900	297.734	73.075	6.897	174.594	2.752	36.749	18.458	10.282
3	la Barceloneta	951.315	426.500	113.036	60.000	6.295	05.032	20.139	39.271	73.395	13.774	3.627	0	666
4	Sant Pere, Santa Caterina i la Ribera	1.915.220	1.054.211	95.397	140.573	144.049	106.125	75.012	4.397	40.923	725	12.003	8.435	163.770
5	el Fort Pienc	2.074.293	1.270.613	223.804	127.493	167.355	132.426	45.689	10.545	31.743	20.939	5.986	30.715	6.985
6	la Sagrada Família	2.932.511	2.030.923	313.716	224.625	211.990	81.623	9.634	32.868	11.139	4.394	1.786	4.386	5.429
7	la Dreta de l'Eixample	6.547.575	3.054.069	467.237	687.863	660.074	1.210.142	153.054	60.081	270.088	10.977	46.784	29.154	48.252
8	l'Antiga Esquerra de l'Eixample	3.976.914	2.307.670	366.121	330.596	237.973	342.903	91.524	151.575	70.643	6.445	20.592	9.350	25.426
9	la Nova Esquerra de l'Eixample	4.039.061	2.437.043	486.711	295.177	258.058	272.683	97.502	63.637	48.129	11.405	10.464	11.213	47.039
10	Sant Antoni	2.419.417	1.627.729	203.400	230.388	147.417	102.303	25.118	24.116	21.080	13.979	7.693	11.593	4.601
11	el Poble Sec - Parc Montjuïc	2.673.728	1.211.979	133.483	182.448	224.957	85.905	96.276	9.194	203.583	202.720	7.674	13.885	301.634
12	la Marina del Prat Vermell - Zona Franca	4.080.236	80.366	876.677	248.943	2.501.712	277.121	36.364	2.424	8.966	8.074	165	0	39.434
13	la Marina de Port	1.300.723	913.053	196.263	60.207	81.129	39.296	27.335	5.141	1.044	34.929	1.721	0	725
14	la Font de la Guàrdia	636.775	362.406	66.001	42.077	45.340	7.299	7.270	16	1.299	1.155	724	775	525
15	Hostalfrancs	1.019.056	543.855	110.775	112.542	98.256	47.938	23.849	967	63.513	11.863	2.478	3.020	0
16	la Barceloneta	1.000.424	603.023	122.960	82.967	117.211	41.392	16.788	2.514	1.169	703	1.368	0	10.959
17	Sants - Dadaí	1.103.306	792.901	146.962	109.999	85.217	22.307	10.225	3.039	1.910	6.169	3.294	215	1.031
18	Sants	2.601.326	1.474.932	262.053	251.030	293.437	77.174	52.995	10.926	47.600	0.221	5.040	6.490	2.620
19	les Corts	3.768.917	1.930.739	570.380	346.937	292.498	399.454	52.541	61.738	74.155	18.089	13.332	4.785	4.269
20	la Maternitat i Sant Ramon	2.332.856	957.092	261.444	113.381	149.723	163.808	239.488	23.117	128.238	277.414	3.878	140	25.133
21	Pedralbes	1.536.019	769.908	160.882	28.566	50.089	65.090	275.275	5.452	18.863	38.182	26.877	1.168	106.907
22	Valldividera, el Tibidabo i les Planes	394.940	238.277	28.339	12.707	30.645	1.912	16.723	4.264	12.246	3.940	10.468	30.868	4.661
23	Sarrià	1.970.022	1.170.713	244.344	89.646	92.447	34.051	155.086	50.633	17.230	40.467	42.115	94	24.386
24	les Tres Torres	1.507.900	930.043	241.269	48.846	68.871	70.590	53.859	51.721	12.609	14.942	14.812	59	0
25	Sant Gervasi - la Bonanova	2.426.406	1.399.331	281.149	115.410	114.527	82.852	163.578	130.232	22.022	62.654	38.868	3.430	13.439
26	Sant Gervasi - Galvany	5.086.623	3.097.069	572.499	366.584	230.541	603.040	89.853	83.108	72.481	27.083	30.976	24.616	11.783
27	el Putxet i el Farró	2.099.640	1.430.450	203.043	121.044	97.090	69.690	32.620	23.754	16.260	13.033	10.454	1.709	479
28	Vallcabra i els Penitents	1.001.874	671.781	118.572	43.517	40.782	12.119	27.299	60.500	6.911	13.818	5.859	142	474
29	el Coll	348.798	258.504	36.327	21.367	14.894	3.460	3.872	290	4.836	1.640	910	0	2.698
30	la Salut	831.776	531.938	81.605	36.118	33.896	13.119	20.486	72.953	4.639	22.039	13.737	686	682
31	la Vila de Gràcia	3.307.302	2.230.529	269.501	227.307	263.363	172.971	50.565	25.070	39.599	19.405	47.160	10.347	6.690
32	el Camp d'en Grassot i Gràcia Nova	2.053.060	1.370.600	243.941	120.533	125.002	65.250	40.095	15.046	2.700	24.952	10.119	799	25.135
33	el Baix Guinard	1.299.516	901.962	119.728	91.730	67.732	24.192	36.008	35.637	7.258	3.820	5.356	1.359	3.834
34	Can Baró	410.247	316.139	28.780	22.866	25.952	3.677	8.613	1.258	1.778	1.112	0	0	54
35	el Guinard	1.946.857	1.274.847	172.245	137.149	134.210	28.519	28.892	115.974	11.040	32.004	7.896	2.962	1.119
36	la Font d'en Fargues	636.037	370.267	62.537	13.018	23.491	3.130	25.691	9.956	1.694	12.310	2.718	1.268	662
37	el Carmel	1.256.426	929.677	112.272	62.431	64.523	9.314	29.694	9.327	2.055	12.216	3.277	990	250
38	la Teixonera	481.607	350.018	55.228	33.478	35.129	3.358	2.221	203	719	1.811	0.071	0	1
39	Sant Genís dels Agudells	360.631	247.647	26.323	16.488	13.406	3.421	31.868	4.291	1.051	9.949	4.804	1.395	0
40	Montbau	547.580	157.523	29.467	9.402	47.834	11.426	108.388	157.051	2.513	17.628	6.339	0	0
41	la Vall d'Hebron	350.176	200.796	5.673	6.037	12.530	1.775	22.507	512	10.470	54.501	22.694	0	1.595
42	la Clota	36.800	18.720	888	2.492	12.044	0	1.390	411	0	0	855	0	0
43	Horta	1.415.297	895.799	142.740	95.312	73.583	13.154	48.264	34.200	4.807	83.899	18.159	5.124	256
44	Vilapicina i la Torre Llobeta	1.233.966	836.408	165.512	108.331	63.099	13.896	29.254	7.537	4.418	603	2.297	988	1.653
45	Porta	1.211.324	733.496	219.104	134.033	53.972	9.376	16.973	779	20.073	5.111	2.527	10.656	3.325
46	el Turó de la Peira	586.053	440.161	23.810	31.383	34.212	2.439	18.636	6.088	422	4.753	4.851	0	298
47	Can Peguera	67.195	54.156	3.910	2.907	533	0	5.315	0	0	0	374	0	0
48	la Cuqueta	747.998	511.420	63.859	38.802	13.802	30.426	17.366	3.042	3.196	27.118	1.923	0	37.028
49	Canyelles	813.783	240.026	8.142	19.662	22.129	7.034	7.828	1.768	628	6.198	106	0	364
50	les Roquetes	642.205	407.149	32.684	32.976	28.766	1.862	19.214	1.912	1.519	16.896	257	0	0
51	Veidua	460.487	347.841	30.826	49.733	15.100	2.676	11.629	0	408	499	1.604	0	1
52	la Prosperitat	1.056.511	773.261	94.373	73.744	57.729	8.128	29.371	3.421	1.315	12.738	1.622	707	104
53	la Trinitat Nova	280.136	207.346	3.236	9.402	20.667	936	10.337	3.608	204	3.086	1.436	0	0
54	Torre Baró	117.506	79.042	5.758	6.896	11.880	0	11.414	1.182	616	591	223	0	84
55	Ciutat Meridiana	277.044	233.046	2.009	10.199	7.013	2.279	15.732	456	2.405	1.232	992	0	0
56	Vallbona	93.235	53.674	6.777	7.333	5.317	0	2.746	0	7.485	9.074	82	0	747
57	la Trinitat Vella	409.063	245.837	43.231	33.423	47.732	6.918	11.431	1.890	1.967	2.646	3.253	0	10.735
58	Baró de Viver	110.971	80.163	10.369	11.414	2.004	707	5.883	0	0	0	224	0	307
59	el Don Pastor	1.471.915	946.570	36.294	197.351	790.037	70.114	0.631	5.415	5.294	2.546	1.043	0	562
60	Sant Andreu	2.827.818	1.900.059	302.152	232.181	237.551	38.591	52.893	18.094	10.866	29.307	11.917	1.700	2.507
61	la Sagrera	1.538.539	945.460	175.655	117.331	140.398	42.517	61.459	11.248	2.437	4.752	1.745	0	35.519
62	el Congrés i els Indians	712.226	493.633	62.993	67.583	47.345	9.400	28.226	4.380	4.471	4.929	6.681	0	236
63	Naves	1.057.451	749.901	115.549	96.011	57.021	11.504	12.121	742	3.732	1.105	4.553	3.007	425
64	el Camp de l'Arpa del Clot	1.920.727	1.390.223	101.973	115.713	146.621	29.260	20.029	7.627	10.664	4.952	3.024	830	1.603
65	el Clot	1.308.228	910.017	170.250	100.653	68.339	16.809	23.241	5.878	2.046	4.183	1.792	348	2.672
66	el Parc i la Llacuna del Poblenou	1.888.733	487.868	130.368</										

Table AIV7. Statistics of the city of Barcelona

 **Ajuntament de Barcelona**

ESTADÍSTICA

Dades de la ciutat > Estadístiques del sòl, dels edificis, dels habitatges i del mercat immobiliari > Dades cadastrals de Barcelona > Els locals cadastrals > Superfície dels locals > Any 2009




1. Superfície dels locals cadastrals segons usos desagregats. 2009

1.1. Superfície dels locals cadastrals per districtes

Districte	SUPERFÍCIE TOTAL (m2)	Superfície dels locals cadastrals segons usos											Altres usos
		Habitatge	Aparcaments	Comerç	Indústria	Oficines	Ensenyament	Sanitat	Hostaleria	Esportiu	Religiós	Espèctacles	
BARCELONA	110.138.327	62.876.757	11.344.650	8.208.518	11.330.170	5.090.442	3.241.650	1.558.564	1.099.734	1.423.516	611.673	379.011	1.172.542
1. Ciutat Vella	7.586.682	3.961.564	423.763	630.082	483.329	708.903	346.350	65.450	488.209	28.697	81.828	81.205	276.301
2. Eixample	21.989.771	12.728.055	2.050.988	1.883.842	1.572.867	2.142.160	422.521	332.822	460.822	68.139	93.304	98.418	137.732
3. Sants-Montjuïc	14.263.864	5.903.485	1.916.154	1.110.293	3.448.277	597.452	271.002	42.220	329.092	273.034	22.454	24.305	356.936
4. Les Corts	7.637.792	3.657.739	992.506	400.004	492.290	600.352	567.304	90.307	221.246	333.685	44.007	8.003	135.309
6. Sarrià-St Gervasi	19.498.539	8.273.891	1.850.682	752.217	824.129	782.923	512.519	343.912	154.048	182.119	147.713	80.786	54.642
6. Gràcia	7.622.898	5.071.352	749.846	457.022	477.937	266.927	151.116	174.667	58.772	81.934	77.785	19.953	35.587
7. Horta-Guinardó	8.630.174	5.671.395	755.881	510.423	510.842	102.005	344.484	367.218	46.383	227.620	73.168	13.078	7.656
8. Nou Barris	6.937.451	4.917.924	660.109	515.241	334.009	70.941	195.815	28.793	44.750	66.866	18.299	12.220	43.604
9. Sant Andreu	8.127.903	4.781.551	735.543	756.094	1.325.930	169.051	100.644	41.717	28.767	45.365	27.426	4.787	50.300
10. Sant Martí	13.722.373	7.849.801	1.409.197	1.098.320	2.069.672	562.928	250.005	71.458	156.637	115.257	25.607	81.016	74.475

Nota: la superfície dels locals cadastrals és la pròpia del local, sense incorporar la superfície d'espais comuns que caldria repercutir si es volgués calcular valors cadastrals unitaris.

Departament d'Estadística. Ajuntament de Barcelona
 Font: Direcció General del Catastro. Ministerio de Economía y Hacienda.
 Dades obtingudes de les Bases de Dades de l'Impost sobre béns immobles a Gener 2009, facilitades per l'Institut Municipal d'Hisenda. Ajuntament de Barcelona. Elaboració pròpia



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