BEREC
Body of European Regulators for Electronic Communications

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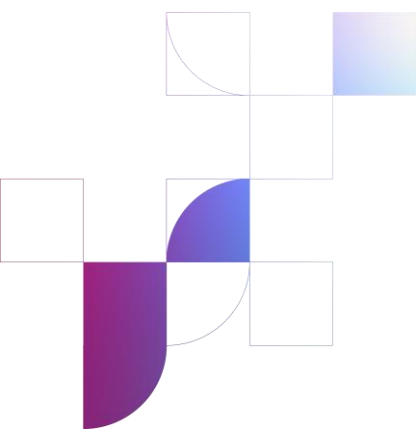
BEREC Report on the regulation of physical infrastructure access



5 June 2025

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Executive Summary

Facilitation of access to physical infrastructure is seen as an important factor to incentivize the deployment of very high-capacity networks, where this infrastructure exists and can be used to reduce the costs associated with networks rollout. The regulatory toolkit provides for several means to motivate operators' investments by facilitating access to relevant physical infrastructure elements and BEREC sought insights into how this was done in Europe, primarily through significant market power-based regulation.

In order to inform this activity, BEREC collected evidence and relevant information from 29 countries in Europe. Those countries together with the responding National Regulatory Authorities (NRAs)[1] are listed in Annex I of the present report. The data were collected in July 2024. The BEREC questionnaire had in view topics such as availability/reusability of the physical infrastructure for the rollout of high-capacity networks, the way in which physical infrastructure access had been treated in the market analyses and how corresponding relevant markets had been defined, data collection for the market assessment, the physical infrastructure elements that were under the scope of the specific obligations and what were the obligations that applied (including details about the transparency obligation and aspects related to the quality of the SMP offer), aspects related to the feedback received by the NRAs on the market notifications, asymmetric and symmetric regulation for physical infrastructure access and their role for incentivizing the rollout of networks and, finally, forward-looking, the expected evolutions and challenges ahead that NRAs could identify at this stage. Therefore, the current report presents BEREC's findings related to all the aforementioned issues.

Going forward, chapter 1 provides an overview of access to physical infrastructure in Europe, be it the one owned by telecommunications and/or non-telecommunications operators, as well as the strategies undertaken by electronic communications operators when aiming to expand their network and needed to make use of physical infrastructure elements. Thereafter, chapter 2 looks at how NRAs have considered physical infrastructure in their relevant market reviews, if and at which stage physical infrastructure was assessed and whether SMP operators have been imposed physical infrastructure access obligations. Chapter 3 details the data collection exercise that NRAs had to do in order to conduct their market reviews, especially as regards the data to be collected/submitted by non-telecommunications operators (i.e. other networks' operators). Chapter 4 considers the specific SMP-based obligations imposed by NRAs, while Chapter 5 looks at both asymmetric and symmetric regulation in the context of incentivizing the deployment of very high-capacity networks, including providing some examples from certain countries. It also considers the interplay between asymmetric and symmetric regulatory tools in achieving the connectivity goals sought in terms of incentivizing network roll-out. Chapter 6 puts forward NRAs' expectations for the future, as well as identifying the challenges ahead. Finally, section 7 concludes.

From the outset it is important to note that BEREC's report is focused on the use of physical infrastructure access for the deployment of fixed very high-capacity networks. Thus, despite some of the questions referring to masts and towers as well, the vast majority of the findings presented here is related to the fixed broadband networks. This is not to say that 5G rollout is not important or very relevant for the discussion, but since no markets related to the mobile access are recommended as susceptible to *ex ante* regulation by the European Commission and since that reflects the starting point of BEREC's current work, the report does not, in principle, cover aspects related to the role of physical infrastructure in enhancing mobile broadband networks rollout. However, considering the fibre backhaul segment that can be used for the deployment of both types of networks (fixed and mobile), BEREC does present some information in what follows, dependent on the answers received.

[1] For clarity, not all NRAs responded to each of the questions, depending on their specific situation.

Finally, BEREC highlights that the current report has to be seen in the broader context of the work that the organization is doing, with primary reference both to, amongst others, the BEREC Regulatory Accounting in Practice Report 2024[2], as well as the BEREC Report on infrastructure sharing as a lever for ECN/ECS environmental sustainability[3].

1. Overview of access to physical infrastructure in Europe

This chapter presents an overview of the main trends in the provision of access to both telecommunications (telco, hereafter) and non-telecommunications (non-telco, hereafter) operators' physical infrastructure (PI in the following) in the national markets of BEREC members.

The access to both telco and non-telco PI is available for the deployment of both fixed and mobile very high-capacity networks (VHCNs) in almost all the countries that contributed to this report (26 out of the 29). In Albania, Liechtenstein and the Netherlands, access to non-telco PI was not available for networks deployments.

As for the other 26 countries, while being available, the PI access (PIA) was not taken-up yet in Denmark and Greece. In Greece, several regulatory measures were being adopted to make such access effectively available, whereas in Denmark alternative network operators tended to deploy their own infrastructures as the main strategy.

In the Netherlands there was no effective access to the telco PI either, but the largest fibre-optic companies had, at that stage, made commitments to grant access to their infrastructures to other providers. In Belgium there was also little PI available because the copper network had been mostly buried directly into the ground and the coaxial network was mainly deployed on buildings' facades.

The market dynamics are described based on the take-up of the telco operators' and non-telco operators' PI. In particular, the scenarios that could be defined based on the relative use of the main alternatives that the telco operators had at their disposal to deploy a VHCN were (i) the deployment of their own PI, (ii) access to other telcos' PI and (iii) access to non-telcos' PI[4].

As depicted in table 1, the competitive landscape varied across Europe in the sense that none of the scenarios mentioned below clearly prevailed over the others. Nonetheless, the balanced scenario, where the above three alternatives played a role in different geographic areas (scenario e) and the own infrastructure scenario, where the roll-out was mainly based on the deployment of own civil infrastructure (scenario a) reflected the situation in 15 markets. It is noteworthy, that there was no case in which the telco operators mainly used access to non-telco operators' PI, with minimal own deployment or access to other telcos' infrastructure.

Table 1. Infrastructure-based competition depending on the mix of PI

Considered scenario	Country
a) Telco operators mainly deploy their own physical infrastructure and the access to both telco and non-telco physical infrastructures is minimal	CZ, DK, IE[5], NL, NO, RO, and SE
b) Telco operators combine the deployment of their own physical infrastructure with the access to other telco physical infrastructure. The access to non-telco physical infrastructure is minimal	AL, LT, LV and SI

[2] BoR (24) 166, BEREC Report Regulatory Accounting in Practice 2024, 10 December 2024. https://www.berec.europa.eu/en/all-documents/berec/reports/berec-report-regulatory-accounting-in-practice-2024

[3] BoR (25) 68, BEREC Report on infrastructure sharing as a lever for ECN/ECS environmental sustainability, 10 June 2025. https://www.berec.europa.eu/en/all-documents/berec/reports/report-on-infrastructure-sharing-as-a-lever-for-ecnecs-environmental-sustainability.

[4] A more detailed description based on market shares was not possible: (i) most NRAs stated that the requested data as regards this indicator but it was not available and (ii) only 9 NRAs had provided figures, which were not necessarily comparable.

[5] There is an exception where the Roll-out of State Aided FTTH is done using other telco infrastructure.

c) Telco operators combine the deployment of their own physical infrastructure with access to non-telco physical infrastructure. The access to telco physical infrastructure is minimal	BE[6]
d) Telco operators combine the access to telco physical infrastructure and the access to non-telco physical infrastructure. The deployment of their own physical infrastructure is minimal	EE, HR, PL and PT
e) Telco operators combine the deployment of their own physical infrastructure, the access to telco physical infrastructure and the access to non-telco physical infrastructure	CY, DE, ES, FI, HU, IT, MT and SK
f) Telco operators mainly use the access to other telco operators' physical infrastructure. The deployment of their own physical infrastructure and the access to non-telco physical infrastructure are minimal	BG, FR and LI
g) Telco operators mainly use the access to non-telco operators' physical infrastructure. The deployment of their own physical infrastructure and the access to telco physical infrastructure are minimal	No country

The rollout of own PI and, to a lesser extent, the access to telco's physical networks were the most important alternatives for the purpose of deploying a VHCN, according to responses of 16 and 10 NRAs, respectively[7].

The NRAs that considered access to telco's PI relevant[8] further specified that such access was predominantly sought to the incumbent operator's infrastructure. RU was the only NRA that referred to the access to alternative telco operators' PI as being highly relevant as well, as detailed in table AII.2 of Annex II.

Finally, all those NRAs that considered access to non-telco PI as playing an important role in their national markets[9] indicated that the production, transport or distribution of electricity was the main/most active sector (i.e. relevant for their market analyses). This was followed by transportation services[10], the public sector bodies (such as local administrations) and the production, transport or distribution of water[11] were the other sectors and/or activities (different from the provision of electronic communications services) that 5, 3 and 1 NRA(s) referred to, respectively. The breakdown of the NRAs' answers is included in table AII.3 of Annex II.

Overall, the data showed that:

(i) the access to telco operators' PI concerned almost exclusively the incumbent operators' PI,

(ii) the access to non-telco operators' PI was the least important alternative as compared to the deployment of own PI and the access to telco incumbent´s PI and

(iii) the access to non-telco's PI mainly concerned the PI for the supply of electricity, followed by that of transportation services.

2. Physical infrastructure access under *ex ante* market assessments

The purpose of this chapter is to display information on the kind of PI (depending on the owner, on the status of the operators – incumbent/alternative etc., as presented in the overview) included in the assessment of the relevant market(s) regulated by the NRAs surveyed. In addition, BEREC examines whether PI was specifically included in the construction of remedies' (even when it was not included in the market definition). Finally, at the very end of this chapter, BEREC presents the results of its enquiries related to the market regulation

[6] In Belgium, the non-physical PI concerned access to poles. This was mainly limited to less urban areas.
[7] See table AII.1 of Annex II.
[8] 18 NRAs considered their national markets to better fit in one of the scenarios that contained the access to telco operators' PI (i.e. scenarios b, d, e or f).
[9] 12 NRAs considered their national markets to better fit in one of the scenarios that contained the access to non-telco operators' PI (i.e. scenarios c, d, e or g).
[10] Including railways, roads, ports and airports.
[11] Including disposal or treatment of waste-water and sewage, and drainage systems.

feedback, referring both to the comments to the notifications by the European Commission in the context of the Art. 32 EECC procedures (if any) or the challenges of the NRAs' decisions in national courts.

Out of the 29 NRAs surveyed, 14 (48%) responded to this section, including OCECPR who stated that they included PIA as part of any market assessment they undertook and ANCOM who said that they did not. This left 7 NRAs who have defined and 5 NRAs who prospectively intended to define PIA as either **a standalone market or include it as part of another product market**, as detailed in table 2 below.

Table 2: Physical infrastructure access from the market analyses standpoint

PIA as a part of a relevant market	NRAs
PIA as a standalone market[12]	
Published decision	ARCEP, ANACOM and ComReg
Published consultation	AKEP, ECPTRA and SPRK
Future plan	CNMC
PIA as part of the WLA[13] *market*	
Published decision	AK, BIPT, NKom and UKE
Future plan	MCA[14]

BEREC also gathered information about the stage of the market assessment (whether the decision was already adopted or a public consultation was held, or it was only at the stage of intention). The answers ranged from 'published decision' to future plans. 7 NRAs have published decisions relating to PIA, another 3 NRAs were at the consultation phase, and the remaining 2 NRAs had future plans for market reviews that would consider PIA for the purpose of relevant markets susceptible to *ex ante* regulation review. Overall, 3 NRAs have published PIA market reviews where a separate standalone market was identified and 4 other NRAs were in various stages of carrying out such an assessment.

BEREC also enquired about the status of **PIA as a remedy** in any of the relevant markets considered at national level, where PIA was not part of the market definition. 17 (59%) NRAs responded to this question[15], including 1 NRA (ANACOM) who stated they did not include PIA remedies in any of their markets' reviews. This left 15 NRAs who stated that PIA was included as remedies in WLA[16] market reviews and 6 NRAs that included PIA remedies in WDC[17] markets. Further determination of the answers is included in table AII.4 of Annex II. Figure II.4 in the same Annex shows that PIA remedies were part of market review decisions of 14 NRAs, 2 NRAs having held already public consultations, at the time of the data collection.

As regards **the relevant product market definition**, the information presented in what follows is based on the responses from the 12 NRAs identified in table 2 above, who stated that PIA was part of at least one of their market reviews, followed by the responses of the 6 NRAs who have completed separate PIA market decisions or have published a standalone PIA market consultation.

NRAs were asked what type of PI were analysed in the market analysis, at the market definition stage. Their choice concerning the main categories of PI considered, namely (i)

[12] As of July 2024, Bulgaria has also adopted a decision defining a PIA standalone market, case BG/2024/2521.
[13] Wholesale local access at a fixed location, market 1 of the 2020 Recommendation on relevant markets.
[14] The EU Commission have asked MCA to carry out their analysis again after issuing serious doubts on case MT/2024/2484.
[15] The relatively low response rate is explained by the complementarity of this information with the data presented above. This is because PIA can be either included in the relevant market or set up as a remedy. Additionally, if no assessment had been done on PIA, then there would be no answers to the questions by the respective NRAs, but this was hardly the case.
[16] Wholesale local access provided at a fixed location, market 1 of the 2020 Recommendation on relevant markets (former market 3a/2014).
[17] Wholesale dedicated capacity, market 2 of the 2020 Recommendation on relevant markets (former market 4/2014).

ducts and pipes, (ii) chambers and manholes, (iii) poles and masts is outlined in table AII.5 of Annex II[18].

Overall, 9 NRAs stated that they included ducts or pipes in the market definition assessment, only 6 NRAs included chambers and manholes in the analysis, while 8 NRAs looked at poles and masts in the given context. Moreover, looking at the breakdown of the stage of the adoption of the respective market assessments as of July 2024[19], the data (see also table AII.6 in Annex II) shows that, from the 6 NRAs who completed a standalone PIA decision or consultation and included the relevant PI in the focal product, all 6 introduced ducts and pipes, 5 chambers and manholes, 4 poles and/or masts, with only 1 NRA having considered dark fibre, in the category of "others".

At the same time, the NRAs were asked if non-telco's infrastructure were included in the product definition of PIA. 5 NRAs responded to this question, with 3 NRAs[20] indicating that it was included. Out of these 3 NRAs, all included electricity poles, while 1 NRA (ARCEP) included electricity ducts and chambers and another (ANACOM) covered road infrastructure.

Table AII.7 in Annex II shows the breakdown by the most relevant infrastructure types included in the product market definition of NRAs who carried out a review of standalone PIA market. Unsurprisingly, telcos related PI is the one covered by all the NRAs (telcos infrastructure alone was the most common definition used by 3 NRAs), but electricity PI was highly relevant in France and Portugal, while transportation services-related PI was recognized as part of the market in Portugal. Finally, all the 6 NRAs stated that the geographic scope of PIA market was national.

BEREC also looked at the stage of **competition/SMP assessment** and how the 6 NRAs proceeded with it. They were asked how many competitors with a market share above 5% were included in the relevant market for PIA. 5 NRAs responded to this question and the responses are included in table AII.8 of Annex II. By and large, there are 2 competitors in the case of 4 NRAs, 2 telco PI owners in one case and a telco plus a non-telco PI owner in the other. There was just 1 competitor mentioned for the other NRA. Out of these 5 NRAs, 4 NRAs designated a single operator with SMP while 1 NRA (AKEP) did not designate any operator with SMP.

2.1. Market assessment feedback

NRAs were asked if any issues were raised, in the context of Article 32 proceedings or national courts, in relation to PIA across the 4 relevant markets, namely the wholesale market for physical infrastructure access (PIA), the market for wholesale access provided at a fixed location (WLA), the market for wholesale central access provided at a fixed location for mass-market products (WCA[21]) and the wholesale market for dedicated capacity (WDC). 13 NRAs responded to this question and 10 indicated there were no issues raised in any of the 4 markets relating to PIA. It is clear from table 3 presented below that the issues raised have been in the markets downstream of PIA, which only 3 NRAs[22] had decided upon at the time of survey. Two of the three markets (WLA and WDC) where challenges had been made are

[18] The category of "others", as mentioned by the 3 NRAs that chose that option, covered sewers, access to buildings and dark fibre.
[19] When the data was collected, as mentioned in the executive summary section.
[20] AKEP, ANACOM and Arcep.
[21] Former market 3b from the 2014 Recommendation on relevant markets susceptible to *ex ante* regulation.
[22] Please note that, as of the date of the publication of the draft Report, the number is higher and may be even higher when the final document is published. Table 2 above provides a forward-looking indication in that regard.

recommended markets in the 2020 EC Recommendation and where most PI-related remedies are likely to be located by the majority of NRAs.

Table 3: Issues raised on PIA by the European Commission or National Courts

Concerned markets	NRAs
PIA	No NRA
WLA	AKOS, BNetzA, CNMC and NMHH
WCA	BNetzA
WDC	BNetzA

3 NRAs[23] indicated that the issues were raised before national courts, while 1 NRA (CNMC) stated that the EC's comments on their WLA market review suggested the need to develop a separate market for PIA.

These NRAs were asked how they addressed the issues raised. At the time of the data collection by BEREC, 2 NRAs (AKOS and NMHH[24]) stated they were awaiting a national court decision, while CNCM stated that they would consider a separate PIA market in the context of the next review of the broadband markets.

3. Data collection for the market assessments

Data collection for the purpose of market assessments has been covered in several of the BEREC documents and the practice is, in principle, well established. However, for the purpose of the present report, BEREC considers that it can bring added value to look at the data collection that had been done with respect to the use of PI of non-telco operators. Such non-telco's PI becomes more relevant in the context of the costly deployment of VHCNs. Recognizing that civil engineering works were not required for every network deployed, in every region, BEREC explores the data collection by NRAs on infrastructure utilised for the deployment of electronic communication networks from non-telco operators in the context *ex ante* market analyses, where relevant. Such PI fall into two categories, namely (i) telco infrastructure owned by a non-telco operator (such as local authorities, municipalities etc.) and (ii) non-telco infrastructure owned by non-telco operators (such as electricity, water supply, transportation etc.).

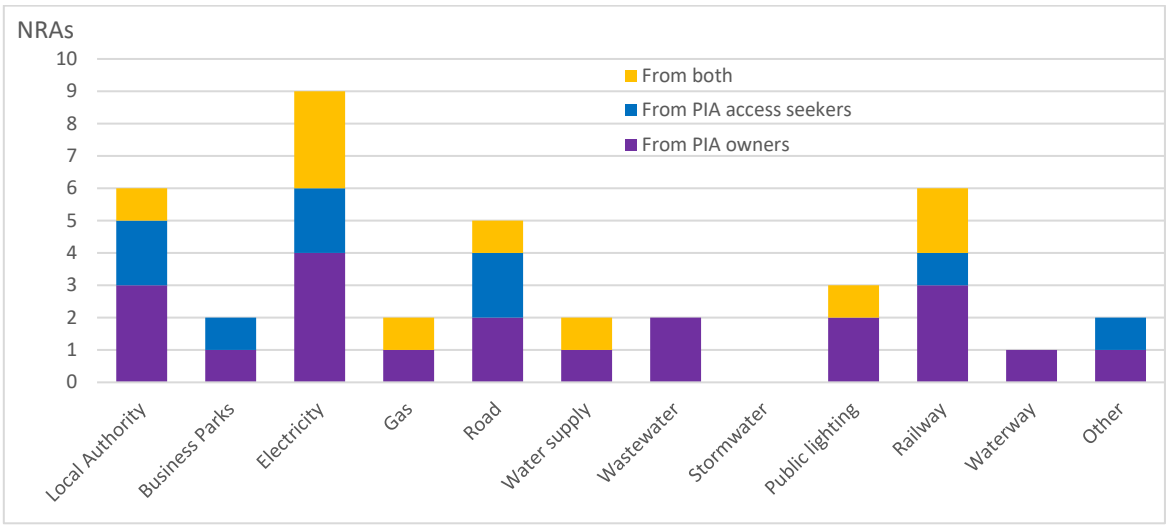
Out of the 29 NRAs surveyed, 26 (90%) responded to this question and 11 stated that they did not collect data from either of the groups in the process of the relevant market reviews. The breakdown of responses from the remaining 15 NRAs is illustrated in table AII.9 of Annex II, with 9 NRAs having collected data from group (i) and 13 NRAs from 'group (ii)'. There is a noteworthy overlap between the NRAs that collect such data, with 7 NRAs collecting data from both groups.

As a follow-up to the question above, BEREC was interested in finding out which type of infrastructure the data referred to. As of group (i), two main categories of owners had been identified, namely local authorities and big business parks. 6 NRAs stated they collected data on the former and 2 stated they collected data on the latter. Besides the main categories, under the 'other category' 1 NRA (AK) mentioned they collected data on the telco infrastructure of the electricity network owner, which was separate to its electricity network infrastructure. 9 types of owners of PI from group (ii) were identified as well, such as electricity, gas, road, water supply, wastewater, stormwater, public lighting, railway and waterway. Unsurprisingly, the most common category that NRAs collected data on was from electricity companies, the option chosen by 9 NRAs, with stormwater infrastructure at the other end, being the least popular category, with no NRA collecting this type of data. Figure AII.10 in Annex II details these results.

[23] AKOS, BNetzA and NMHH
[24] In NMHH's case, the Court decided in favour of the regulator meanwhile.

NRAs were also asked who provided the source of information on these alternative types of infrastructure, whether it was the owner of the infrastructure itself, its user/consumer/access seeker or both. Figure 1 breaks down the responses from those NRAs that stated they collected information on non-telco PI, also incorporating the ownership aspect. The majority of NRAs got this data from the owners of the infrastructure. NRAs received the data from the access seekers in only 5 of the 11 categories explicitly identified in the survey. In 7 of the 11 categories, some NRAs collected data both from the owners and the access seekers of infrastructure.

Figure 1: Source of NRA data collection on non-telecom PI[25]



Finally, those 15 NRAs who stated they collected data regarding either group (i) or (ii) were asked what type of data they collected. It was clear that basic data, such as the type of infrastructure (10 NRAs) and its corresponding quantity (9 NRAs) were the most gathered pieces of information. Most of the other types of data provided as a choice in the questionnaire (see Annex II, Q AII.11 and the corresponding figure for details) were collected by only 3-4 NRAs, with questions related to the contractual aspects (start date, duration and type) collected by 1-2 NRAs. Among the other type of information collected, the following were included by some NRAs: (i) accuracy of geographical position, (ii) height or installation depth of PI, (iii) availability of power supply, (iv) existence of publicly funded PI, (v) current state of infrastructure (degree of usability and alike), (vi) mode of use and (vii) contact information on access to infrastructure.

4. Remedies

4.1. General overview of the SMP remedies

This section provides a general overview of the scope of the remedies applied by NRAs when imposing *ex ante* wholesale obligations for access to PI, irrespective of whether this was done in a standalone PIA market or as part of remedies imposed in a related relevant market. In this regard, BEREC's interest was related to topics such as the PI elements to which SMP

[25] Data provided by PIA owners: **Local Authority:** AKEP, BNetzA and HAKOM; **Business Parks:** ECPTRA and HAKOM; **Electricity:** AKEP, BNetzA, ECPTRA and OCECPR; **Gas:** BNetzA; **Road:** AKEP and BNetzA; **Water supply:** OCECPR; **Wastewater:** BNetzA and OCECPR; **Public lighting:** BNetzA and OCECPR; **Railway:** BNetzA, ECPTRA and UKE; **Waterway:** UKE; **Other:** AK and UKE;
Data provided by PIA access seekers: **Local Authority**: ANACOM and ComReg; **Business Parks**: ComReg; **Electricity**: ANACOM and ComReg; **Road**: ANACOM and ComReg; **Railway**: ComReg; **Other**: ANACOM;
Data provided by both PIA owners & access seekers: **Local Authority**: MCA; **Electricity**: CNMC, MCA and RU; **Gas**: CNMC; **Road**: MCA; **Water supply**: MCA; **Public lighting**: MCA; **Railway**: CNMC and RU.

obligations apply, the relevant delineation of the part of the network that they apply to, as well as the specific access conditions. At the same time, NRAs were asked about the geographic delineation of the SMP remedies and if wholesale-only operators and/or publicly funded VHCNs were also regulated under the SMP regime.

Regarding the main elements to which access obligations had been imposed, the breakdown of the answers by NRAs is included in table AII.12 in Annex II. BEREC notes that regulated access to ducts/pipes has been the PI obligation most used by NRAs (19 NRAs), in most cases also encompassing access to chambers/manholes (17 NRAs)[26]. Access to poles was also generally imposed as a remedy in those countries where this type of PI access was needed for the networks' rollout (14 NRAs).

Additionally, dark fiber was regulated as auxiliary to the PI wholesale access services by 12 of the NRAs out of the 20 that replied to this question in the survey. For example, in France access to dark fiber was imposed only in the case of backhaul, while in Belgium dark fiber was only an alternative in the case of the drop cable, when there was no duct available. In the same vein, in Portugal when there was no space in a certain duct, the obligation for access to the dark fiber of the SMP operator applies, as it does in Ireland as well. But there were other approaches, as well – in Italy, dark fiber was imposed as a remedy independently from the availability of access to PI (i.e. dark fiber was seen as a distinct remedy). In a similar vein, in Liechtenstein the main obligations pertained *de facto* to access to the dark fiber loop and access to civil assets was subsidiary. Finally, in Croatia the SMP operator on the WLA and WCA markets was obliged to provide a dark fiber service for backhaul link up to the access points where the wholesale services are provided.

When asked about the scope of PI in relation to the networks' part they apply to, NRAs had generally indicated that in-building infrastructure was deemed outside the scope of SMP physical access regulation (14 NRAs excluded explicitly in-building cables from the SMP access obligations). Some of the reasons mentioned by NRAs pointed to the fact that the in-building infrastructure belonged to the owner of the building (AK and ANACOM), that access to it was covered by specific/national legislation that transposed the BCRD/GIA[27] or that it may be considered as part of symmetric regulation (ComReg), the respective NRAs having seen therefore no need for extra regulation under the asymmetric regime.

A detailed overview of the answers is provided in table AII.13 of Annex II. Most NRAs (18) that responded to this question regulated the access to the local segment[28]. In the case of NKom, the market decision limited the PIA obligation to areas where the SMP operator did not deploy a fiber-based VHCN network, as in areas with deployment by the SMP operator other wholesale access products were found available. Likewise, a considerable number of NRAs (16) regulated the access to backhaul[29] as well. However, the picture is more nuanced regarding regulation of the entire physical network (e.g. including the backbone segment). 10 NRAs replied that regulated access to the entire physical network is within the scope of the *ex ante* regulation. As an example, ComReg explained that, on the basis of its market decision, the obligation of access to PI means that any authorized operator involved in the provision of an electronic communications network and/or service, regardless of the nature of the network (access and/or core network) or service (and which may include without limitation broadband, broadband enabled services, such as IPTV, VOIP, leased lines, fronthaul/backhaul for fixed and mobile services, including inter-connecting co-located equipment etc.) can avail of regulated access to PI from the SMP Operator.

[26] OCECPR indicated that it had imposed colocation as a remedy in the context of its *ex ante* review of the markets, which included all PIA elements.
[27] AGCOM, ANACOM, CNMC and HAKOM.
[28] In this report, the local access segment means the segment of a VHCN access network which connects an end-user's premises to the first distribution point.
[29] In the fixed networks that the report is essentially focused on, the backhaul segment goes from the first distribution point to a point of presence of the alternative operator.

Another point that BEREC raised in its survey was related to what services the regulated access can be used for. In general, the respondents stated that there were no restrictions for regulated access to PI. For instance, CNMC indicated that access to PI within the context of the *ex ante* market reviews was agnostic in that different types of usage (mobile backhaul, business services, provision of dedicated capacity such as leased lines etc.) were allowed. SPRK indicated that access to PI could be used by both mobile and fixed operators for the installation of optical fiber. Likewise, 10 NRAs[30] noted no specific conditions were attached to the regulated wholesale access to PI of the SMP operator in their Member States.

However, BEREC notes that limitations on usage may be linked to the way in which the markets have been defined. Besides NKom's case that was mentioned above, another example was in Germany where BNetzA sets the PIA obligation in the WLA market, and thus was limited to the deployment of fixed VHCNs and could not be used for WDC access purposes (including the deployment of mobile stations). Likewise, AKOS indicated that PIA was regulated as part of the residential mass market, while other use cases (e.g. mobile backhaul), although outside the scope of the SMP-based access obligations, were possible on the basis of symmetric regulation.

In terms of potential geographical segmentation, all the NRAs that responded (18) noted that the SMP remedies regarding PIA had been imposed on a national level, and thus did not vary geographically, albeit with some nuances. NMHH stressed that, as several operators had been deemed to have SMP, remedies applied to the former concession areas of each of the incumbent operators. In the Italian case, SMP regulation was not imposed in the whole country, as some municipalities had been identified as competitive (i.e. *ex ante* regulation did not apply in those areas).

Networks with a particular status, such as wholesale-only and/or publicly funded, were out of the scope of PI regulation in an asymmetric setting. Most of the NRAs (18 out of 20 that responded) supported this view. However, BIPT indicated that the wholesale-only operators and/or publicly funded VHCNs that were jointly controlled by SMP operators had inherited the regulatory SMP obligations imposed by the NRA. Finally, AGCOM noted that the SMP operator had recently notified its separation into a wholesale-only undertaking and a new market analysis was starting soon to assess the impact of this modification on SMP conditions and related remedies.

4.2. Remedies applied by NRAs to physical infrastructure

This section outlines NRAs' views on the specific remedies applied to PI. NRAs were queried about the regulated network elements and the corresponding selected forms of the obligations for access, transparency, non-discrimination and equivalence of access, price control and accounting separation, as established through the market reviews.

As regards the type of network elements that were covered by regulation, ducts and pipes were almost universally regulated across countries (95% of the NRAs), as listed in table AII.14 of Annex II, underscoring their critical role in network deployment. Chambers and manholes were also widely regulated, though slightly less so than ducts and pipes, being included in the regulatory frameworks of most NRAs but absent in 3 countries[31]. Poles were less regulated when compared to ducts, pipes, chambers and manholes, being included in the regulatory frameworks of 13 NRAs and absent in 5 cases[32].

4.2.1. Ducts and pipes

Firstly, as regards the regulation applicable to **ducts and pipes**, when considering the **access services** provided by the SMP operators, they most commonly had to offer (i) unblocking

[30] AGCOM, AKEP, ANACOM, AK, BIPT, ComReg, ECPTRA, HAKOM, OCECPR and RRT.
[31] BIPT, EETT and RU.
[32] AK, BIPT, HAKOM, RRT and RU.

and/or repairing of PI[33] (14 countries) and (ii) feasibility analysis (14 countries). Cable removal was mandated in 12 countries, while interventions in ducts (e.g. cable replacement, joints) were obligatory for the SMP operators in 10 countries. Cable installation was imposed by only 8 NRAs[34]. Moreover, in case of Portugal and Ireland, the access seeker/customer could install the cables in the SMP operator's ducts by itself. Details regarding the various combinations that the NRAs have chosen are included in table AII.15 of Annex II. Regarding other wholesale services mentioned by NRAs, 7 NRAs considered restrictions regarding the cables which can be used, while another 7 determined that the SMP operator is allowed to require certification for access seekers/alternative operators' personnel.

In terms of **transparency** applicable to the PI of the SMP operators, 7 NRAs[35] employed a full suite of transparency measures. These included a reference offer, an online tool or database providing information on PI, such as maps and occupation information, and an automatic system for processing wholesale service requests (e.g. web-interface)[36]. Another 7 NRAs[37] utilized a reference offer along with a database or online tool providing information on the PI, but without the automatic system for service requests. In the case of certain NRAs, however, a reference offer with an automatic system for sending wholesale service requests was combined (AKOS), while UKE used a database or online tool along with an automatic system for service requests. Finally, 3 NRAs[38] implemented only a reference offer. The detailed information is shown in table AII.16 of Annex II.

As regards **non-discrimination** in the provision of access to the SMP operators' PI, 15 NRAs provided data on their performance metrics against which the compliance with such an obligation was assessed. A majority (12 NRAs) utilized a comprehensive approach, incorporating key performance indicators (KPIs), service level agreements (SLAs), as well as services level guarantees (SLGs) (table AII.17, Annex II). 2 NRAs (EETT and HAKOM) employed KPIs and SLAs, while 1 NRA (RRT) relied solely on KPIs. Furthermore, 18 NRAs outlined their approaches towards the assurance of **equivalence of access** towards the PI access seekers with 8 imposing equivalence of inputs (EoI), while another 8 having adopted an equivalence of outputs (EoO) regulation (table AII.18, Annex II). Moreover, 2 NRAs have taken different approaches, with ECPTRA planning to require the SMP operator to assess the feasibility of implementing EoI. In contrast to that approach, SPRK ensured equivalence through the establishment of an online platform providing information on the PI and obliged the SMP operator to publish a detailed description about its access systems and processes used in the provision of PI to itself and access seekers, including but not being limited to the systems and processes used for pre-ordering, ordering, provisioning, fault reporting and repair.

In turn, when considering the **price control remedy** applicable to the PI of the SMP operators, NRAs' responses highlighted the predominant use of cost orientation across Europe, with 15 countries adopting this approach. Details are provided in table AII.19 of Annex II. Additionally, cost orientation combined with other tests such as the retail-minus, margin squeeze test or economic replicability test (ERT) were used by BNetzA and SPRK. BNetzA, for instance, mentioned that, in certain circumstances, it allowed for a surcharge covering the effects of the access provision on the business plan of the network's operator. In a similar vein, BIPT applied a fair pricing approach, ensuring a reasonable margin over costs. Noteworthy, the mix between different price control remedies in the aforementioned cases was related to the fact that NRAs were using different approaches in various areas or considered elements of PI

[33] This is without prejudice on the potential requirements on access to SMP operators' ducts that provide access seekers with the autonomy to perform such activities themselves, depending on the NRA's decision.
[34] AK, ANACOM, BNetzA, ECPTRA, HAKOM, NMHH, OCECPR and SPRK.
[35] AGCOM, ANACOM, ARCEP, BNetzA, CNMC, HAKOM and RRT.
[36] The web-interface can be seen as related to the access obligation rather than transparency, especially when used for correspondence concerning wholesale access requests.
[37] AK, ComReg, ECPTRA, EETT, OCECPR, RU and SPRK.
[38] BIPT, NKom and NMHH.

depending on their degree of amortization etc. At the same time, among 19 NRAs, 13 have adopted SMP PI **accounting separation** remedies, while 6 have not (table AII.20, Annex II).

4.2.2. Poles

Secondly, considering another very important element of PI - the **poles** - BEREC presents in what follows its main findings concerning the establishment of remedies.

In terms of **access services**, SMP operators most frequently were under the obligation to provide repairing of PI (9 countries), as well as to conduct feasibility analysis (11 countries). Cable removal was provided in 8 countries, while interventions on poles (e.g. cable replacement, joints) and cable installation were available in only 5 countries. However, in Portugal, alternative operators could install, remove and/or replace cables themselves on the SMP operator's poles. The breakdown of NRAs' answers is included in table AII.21, Annex II.

Transparency for access to SMP poles differed widely in the particulars from one country to the other where it was imposed, ranging from publishing a reference offer to establishing a database or online tool with a full set of data on PI, plus providing the access seeker with an automated system for correspondence related to wholesale service requests and answers[39], in addition. The results of BEREC's study (presented in detail in table AII.22) show that 7 NRAs employed a full suite of transparency measures. These included a reference offer, an online tool or database providing data on PI (such as maps and occupation information) and an automatic system for processing wholesale service requests (e.g. web-interface). Another 5 NRAs utilized a reference offer along with a database or online tool providing information on the PI, but without the automatic system for service requests. Finally, 2 NRAs only had the SMP operators implementing a reference offer.

In terms of **non-discrimination**, 12 NRAs provided answers related to their performance metrics (table AII.23 in Annex II). A majority (11 NRAs) utilized a comprehensive approach that incorporated KPIs, SLAs and SLGs. Two NRAs employed a combination of KPIs and SLAs, while one relied solely on KPIs. At the same time, as per the information presented in table AII.24 (Annex II), 13 NRAs have outlined their approaches to ensuring **equivalent access** to their PI for other (alternative) operators. Of these, 6 NRAs imposed on EoI, while another 6 adopted an EoO approach. However, 1 NRA (SPRK) stated that they had in place an online tool for placing orders, delivery of services and fault repairs, which allows for the conditions for the provision of access services being available on an equivalent basis to all the interested parties.

Price control remedies for the SMP operators' poles were less detailed than the ones established for access to ducts and pipes taking due account of the intrinsic characteristics of the PI elements under assessment. BEREC found out that 11 NRAs (85% of the respondents) used cost orientation as the appropriate price control remedy, while only 2 NRAs combined cost orientation with other tests such as the retail-minus or margin squeeze tests or an ERT. The breakdown of NRAs' answers by relevant price control remedy is shown in table AII.25. Additionally, out of the 15 answers received, **accounting separation** was imposed in 9 cases, while 6 NRAs did not establish such an obligation (table AII.26 of Annex II).

4.2.3. Chambers and manholes

In addition to the remedies applied to ducts and pipes on the one hand, and poles on the other hand, BEREC also sought information on **chambers and manholes**. Despite the fact that there is little information on regulated access to chambers and manholes in the context of PI regulation, these elements have been considered by NRAs of high importance for effective access.

In terms of **access services**, the SMP operators are most frequently obliged to provide unblocking and/or repairing of chambers and manholes, as well as providing feasibility

[39] The automated system can be seen as related to the access obligation rather than transparency, especially when used for correspondence concerning wholesale access requests.

analyses, with 10 countries imposing obligations in relation to these services. Cable removal and duct interventions related to the chambers and manholes were available in 8 countries. Cable installation was the least common service, offered in only 6 countries. Further details are included in table AII.27 of Annex II.

Regarding **transparency** obligations applicable to SMP operators' chambers and manholes, 7 NRAs made effective a full suite of transparency measures (table AII.28). These included the publishing of a reference offer, an online tool or database providing information on PI (such as maps and occupation information) and an automatic system for processing wholesale service requests[40]. Another 4 NRAs explained that the SMP operator was under the obligation to have a reference offer along with a database or online tool providing information on its PI, but without the need to implement an automatic system for service requests. There are other combinations of transparency measures imposed in the relevant markets, such as 1 NRA (AKOS) combining a reference offer with an automatic system for sending wholesale service requests and another 2 NRAs (NKom and NMHH) having made sole use of the reference offer.

Various options concerning the imposition of the **non-discrimination** obligation applied in Europe, with a majority of NRAs utilizing a comprehensive approach (10 NRAs) that incorporates KPIs, SLAs and SLGs. Additionally, there were 2 NRAs that had relatively simpler measures of non-discrimination, HAKOM with a combination of KPIs and SLAs and ComReg with a mix of SLAs and SLGs (table AII.29 of Annex II). **Equivalence of access** for wholesale access services to chambers and manholes of the designated SMP operators needed for the retail provision of broadband services to end-users have been outlined in the answers of 12 NRAs (table AII.30). Out of these, 5 focused on EoI, while another 6 adopted an EoO approach. Yet, there was one NRA (ECPTRA) that was planning to ask the SMP operator to assess itself the feasibility of implementing EoI and another one (SPRK) that required the offering of an online platform for ordering, provisioning and fault repair.

Concerning the applied **price control** remedies, NRAs' responses highlighted the predominant use of cost orientation as a price control remedy across Europe, with 11 countries having adopted this approach (table AII.31). Additionally, cost orientation combined with other regulatory safeguards such as the retail-minus or a margin squeeze test or a ERT was applied by SPRK. Furthermore, 4 NRAs[41] indicated that access to chambers was not subject to separate charges, as such costs were incorporated in the duct rental fees. Moreover, an obligation of **accounting separation** was imposed by 9 NRAs, while 5 did not establish such a remedy for their SMP operators (table AII.32), out of the 14 responses received for this question.

4.3. Details on pricing of wholesale access to physical infrastructure

In what follows, BEREC presents, in as much a synthesized form as possible, details about the pricing regulation which was adopted in the various countries in Europe for the regulated provision of access to PI of the SMP operators[42]. The need to dedicate a special section to the pricing aspects stems from the difficulties pinpointed by NRAs when establishing such prices, duly noting that there is a real hurdle in trying to compare the situation in one country with the situation in the other, as it will become evident in an instant. Furthermore, such lack of comparability points yet, once more, to the need for a tailored approach to take into account the national specificities, the degree of occupation of PI, the status of the concerned PI (ducts mainly) and similar aspects, with non-negligible impact on how the calculations were made.

[40] The automated system can be seen as related to the access obligation rather than transparency, especially when used for correspondence concerning wholesale access requests.
[41] ComReg, AKEP, AKOS and SPRK.
[42] For a comprehensive overview of pricing/costing decisions see also the BEREC Rregulatory Accounting in Practice Report 2024, BoR (24) 166: https://www.berec.europa.eu/en/all-documents/berec/reports/berec-report-regulatory-accounting-in-practice-2024 .

4.3.1. Access to ducts

BEREC has received a total of 20 responses to the questions regarding the determination of **prices for ducts**. According to the information collected, prices of ducts are cost oriented in the vast majority of European countries who provided an answer (17 out of 20)[43]. Out of the 17 NRAs which set prices based on cost orientation, 15 indicated the use of monthly/yearly charges, while in only 1 case (AGCOM) a pluriannual IRU[44] charging model was applied.

Regarding the tariff structure established, all but 2 NRAs (SPRK and NMHH) used an initial one-off charge, plus monthly (or pluriannual) charges. The aforementioned 2 NRAs responded that only a monthly/yearly fee was charged for ducts use. Moreover, 6 NRAs indicated that there was no cancellation fee versus 4 that did impose a separate cancellation fee. Finally, the majority of responses (9 NRAs) stated that there were additional fees foreseen for regulated access to ducts, while 6 responses indicated that there were no additional fees.

One-off charges vary considerably both in terms of pecuniary amount (from a low of € 38.34 in Estonia to a high of €1,215 in Slovenia, which is used to cover the technical conditions for access), in terms of the suite of services to which they refer (in Spain, for example, charges are imposed for information updates, while supervision fees for the oversight of the works are imposed in Estonia) and in terms of structure (ranging from one overall one-off charge – in France[45] or Norway - to different one-off charges for numerous different services), as detailed in the table below. Furthermore, some NRAs reported that one-off fees are considered additional fees, meaning that a clear-cut distinction between what is initial one-off charge and additional charges that are imposed over the lifetime of the access contract cannot really be discerned. Individual NRAs' responses are summarized in table 4.

Table 4 – Summary of relevant one-off and additional fees for regulated duct access

NRA	Reported one-off charges	Reported additional fees
AK	Feasibility study: 280 CHF	Project planning of the cable pulling project CHF/h 150.
Arcep	639 EUR	N.A.
SPRK	N.A.	Price for access to the GIS tool – 255 EUR/month. Price per theoretical technical research – 126.86 EUR per initial 100 m; 22.02 EUR per every next 100 m. Price for cable installation preparation works – 23.97 EUR per weld removal of cable manhole; 195.93 EUR per cleaning of cable manhole; 77.83 EUR per water pumping from manhole; 69.69 EUR per welding of manhole cover. Price per practical technical research (PTR) – 386 EUR for PTR if length of cable duct is less than 100 m; 1.02 EUR per each meter exceeding the 100 m threshold.
NKom	437 EUR	N.A.
NMHH	N.A.	On-site feasibility survey: 87 EUR for up to 200 m, plus 0.44 EUR per additional m; Cable installation: 0.49 EUR/m; Supervision: 12.74 EUR/hour

[43] NRAs that imposed cost-oriented pricing regulation for ducts are AK, OCECPR, EETT, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg, RRT, RU, AGCOM, ECPTRA, AKOS and ARCEP. NRAs that have not imposed cost-oriented pricing are AKEP, BIPT and UKE. BIPT, however, imposed fair pricing, as presented already.

[44] IRU – Indefeasible Right of Use. In case of IRU contracts, the infrastructure is rented for a longer period (a number of years) and the payment is usually upfront. There is consequently a discount for paying in advance, because the non-recurrent (i.e. IRU) prices reflect the net present value of the infrastructure (which includes WACC), considering, in other words, the value of all future cash flows (i.e. recurrent fees) over the entire life of the infrastructure investment discounted to the present.

[45] In the French case, all the complete necessary information is included in the public reference offer. Orange's reference offer can be found here: https://gallery.orange.com/reseaux/media/8291a387-dde3-4bbb-b065-f18bcf1e2a74/document/2bc59f20-6276-4561-9f66-bfdcad55948b#v=Version1&l=fr&p=31

NRA	Reported one-off charges	Reported additional fees
CNMC	Technical validation[46]: 59.70 EUR (30.85 EUR when only drop cables are included). Site survey: 175.13 EUR + 50.04 EUR x number of visited manholes + 17.52 EUR x number of visited handholes; Information systems updates: 35.82 EUR	N.A.
BNetzA	At a minimum, one-off fees of 335.89 EUR for service provisioning up to 100m duct length. In addition, there are one-off fees for cancellation of 171.90 EUR[47].	Service provisioning surcharge per additional 500m duct length: 49,05 EUR
ANACOM	Feasibility with no alternative route: 63.3 EUR + no of chambers/manholes x 46.1 EUR Feasibility with alternative routes considered: 72.8 EUR + no of chambers/manholes x 46.1 EUR[48]	N.A.
HAKOM	A one-time fee: 344.95 EUR Fee for data download (technical documentation): (i) up to 100 m: 7.96 EUR; (ii) 101-1000 m: 7.96 EUR + 0.0265 EUR /m above 100 m; (iii) from 1001 m: 31.85 EUR + 0.0239 EUR /m above 1000 m.	Incumbent charges for the development of a technical solution: 613.84 EUR + 0.80 EUR/m. Incumbent charges for the supervision of works by an authorized person 29.46 EUR/hour.
ComReg	The cost of processing duct orders must be charged as a one-off cost. These charges must be pre-notified by the incumbent to the NRA and to access seekers before they become effective. These one-off charges have not yet been notified and/or published by the Incumbent and so we do not have any pricing information currently.	These prices assume the assignment of a minimum cross-sectional area in a duct equivalent to a sub-duct of 25mm. Larger or additional sub-ducts/cables with a combined cross-sectional area above the minimum cross-sectional area are subject to higher prices. The increases are linear with the increase of the combined area above a 25mm sub-duct Access seekers are liable to pay for duct remediation costs above a financial threshold of €11,000 per km, if they pay the standard rental price. By contrast, if access seekers pay upfront for all remediation costs, then they pay a reduced duct rental price. The standard and reduced duct rental prices for 2024 are set out in Table 5.
RRT	Technical feasibility test based on actual check on site: 141.91 EUR per 1 km Technical feasibility test based on SMPs database: 78.20 EUR per 1 km	One-off charge for manual intervention into manholes, if technical feasibility of the route is not verified: 43.44 EUR Rewriting the service on behalf of another customer: 40.55 EUR
RU	Hourly rate for the provision of access to PI elements: 72.08 EUR per hour	N.A.
AGCOM	Feasibility study: 268.41 EUR	Cartography update: 389.45 EUR
ECPTRA	Issuance of technical conditions by the SMP operator: 38.34 EUR + 0.10 EUR/m for planning the duct route Coordination services: 28 EUR/piece (an area up to 1 ha) or 70 EUR/piece (an area ≥ 1 ha) Supervision: 44 EUR/hour	N.A.
AKOS	Technical solution for establishing a connection to a building/collocation: from 300 to 1,215 EUR.	Lease of lifting channels and cable shelves: 1.58 EUR for 50 meters.

Overall, the services related to regulated duct access which were subject to charges through one-off or additional fees fell under one of the following main categories:

(i) Access to information on availability of ducts and feasibility of duct access service provision (without on-site survey);
(ii) Technical feasibility studies, which include on-site surveys;
(iii) Technical solution development services;
(iv) Fees charged for cable installation services and preparatory works.

[46] The joint site technical survey with Telefonica can be skipped if the operator meets certain conditions, such as having experience in network deployment.
[47] All pricing details are explained under the following link: Bundesnetzagentur - Entgeltregulierung - Einheitliche Informationsstelle Entgeltregulierung Zugang zum Teilnehmeranschluss
[48] For clarification, in Portugal, when a feasibility analysis request is made with the SMP operator, the alternative operator can indicate if it wants to receive just a route path or also an alternative route path for the cables' installation. Thus, in the reference offer there are 2 prices. Each price has a base component and a variable one depending on the number of manholes/chambers to be crossed.

In relation to the recurrent fees, the pricing structure of monthly/yearly/pluriannual charges also differed considerably between respondents. In most countries, fees were charged on a monthly basis, however 2 NRAs (ComReg and HAKOM) reported that fees were charged annually and in one case (AGCOM) the fee was paid at the beginning of a pluriannual period (within a 5/10/15/20 years contractual timeframe). Most commonly monthly charges were applied per meter/kilometre. However, one NRA (ANACOM) reported that monthly fees were charged per km/cm^2 of the duct, while 2 NRAs (CNMC and HAKOM) mentioned that both per m(km) and per m(km)/cm^2 charging can apply. SPRK noted that there was a different price for the first 100 m of duct and beyond. However, there were also countries differentiating between prices for different segments of the network, applying different prices for rural and urban areas, for instance. At the same time, there are NRAs that reported setting varying charges based on the diameter of the used conduit (the main criterion used for charging was the diameter of the used conduit and/or whether the conduit was duct or subduct), while other NRAs set the same fee regardless of the diameter of the used conduit. Reported monthly/yearly fees are summarized in table 5 below.

Table 5 - Monthly/yearly/pluriannual fees for regulated duct access

NRA	Monthly/Yearly fees
AK	Access: 0.107 CHF/m/month Backhaul: 0.128 CHF/m/month
Arcep	1,054 EUR monthly subscription for each access (the number of accesses, declared by the operator, is equal to the size of the concentration point. This number may be reviewed annually).
SPRK	Access: 36.44 EUR/month per initial 100 m; 4.28 EUR/month per every next 100 m
NKom	Access: 0.7 EUR (urban) / 0.15 EUR (suburban) / 0.1 EUR (rural) per meter per month
NMHH	Access: 53 EUR/km/month
CNMC	Access: (i) Whole subduct with 40mm diameter: 46.50 EUR per km; (ii) Whole duct with 63mm diameter: 130.70 EUR per km; (iii) Section of a subduct with 40mm diameter: 3.70 EUR for each cm^2 per km; (iv) Section of a duct with 63mm diameter: 10.24 EUR for each cm^2 per km. There are separate fees for the use of handholes and manholes. The average price for use of a handhole/manhole is 1.17 EUR per month.
BNetzA	Monthly fees for ducts access up to the street cabinet ("main cable segment") are as follows: (i) Ducts size "S": 0.05 EUR/m/month (inner diameter ≥ 4mm) (ii) Ducts size "M": 0.09 EUR/m/month (inner diameter ≥ 28 mm) (iii) Ducts size "L": 0.37 EUR/m/month (inner diameter ≥ 90 mm) In the distribution cable segment (street cabinet – network termination point), monthly fees are charged on a flat rate basis (not depending on length). The monthly fee varies between 12.72 EUR and 64.48 EUR depending on the number of housing units connected.
ANACOM	For Lisbon/Porto: Access to sub-ducts: 6.89 EUR/ km/ cm^2 and access to ducts: 6.37 EUR/km/cm^2 For other municipalities: Access to sub-ducts: 5.40 EUR/ km/ cm^2 and access to ducts: 4.88 EUR/km/cm^2
HAKOM	Yearly fees for access (valid from 1st August 2024): (i) Ducts with outer diameter 63-110 mm: 0.3758 EUR/m/year or 0.0122 EUR/m/cm²/year (ii) Ducts with outer diameter 50 mm: 0.2367 EUR/m/year or 0.0356 EUR/m/cm²/year (iii) Ducts with outer diameter 20-40 mm: 0.2093 EUR/m/year or 0.0574 EUR/m/cm²/year (iv) Microducts with outer diameter 3-16 mm: 0.1366 EUR/m/year
ComReg	Standard Access/Direct Duct Access: (National): 2024: €0.5 per metre, per year. Reduced Access/Direct Duct Access: (in commercial areas): 2024 €0.37 per metre, per year. Reduced Access/Direct Duct Access: (in intervention areas): 2024: €0.29 per metre, per year. Sub-Duct Access (National): 2024: € 0.06 per metre, per year, on top of the duct access prices above
RRT	Access to ducts: 27.00 EUR/km, per month
RU	Access to ducts: 0.218 EUR/m per month Access to HDPE (high-density polyethylene) pipes[49]: 0.092 EUR/m per month Access to tubes: 0.087 EUR/m per month
AGCOM	Access to 1 subduct for 5/10/15/20 years: 3.18/5.40/6.95/8.03 EUR/m (2024), per month. In case more than 2 subducts are purchased, prices are discounted
ECPTRA	Access: 0.049 € per cable channel in duct per meter per month
AKOS	72.09 EUR per km per month

[49] HDPE pipes are tubes of limited length located directly in a trench in the ground, in an opening of a duct or in a protector made of HDPE material, meant for installing cables, multitubes or tubes.

In conclusion, BEREC notes the wide variety of the charging patterns (nevertheless, we can say that there is broadly a rental element and a one-off fee in whichever form), the different timespans to which the payments from the access takers are due, as well as the distinct units of measurement to which the prices refer to. Differences in pricing may *inter alia* be explained by varying labour costs, the age of the PI (whether they are old or new), the costs charged by building companies and other costs which are country specific. Therefore, some NRAs have identified comparison difficulties, which, in turn, goes to explain why benchmarking was generally not used in setting the price remedies for PI elements.

4.3.2. Access to poles

BEREC has also looked at **pricing** related to regulated **poles' access**, having received 17 responses to this topic. As in the case of duct access, most responses (14 over 17) indicated the use of cost orientation for determining prices for access to poles[50].

Similar to the pricing of regulated access to ducts, recurrent charges were imposed in all the 14 countries imposing cost-orientation. Again, the combination of one-off charges and monthly fees was the most common. Only 3 responses indicated that no one-off charges for access to poles were imposed. Pluriannual charges were perceived again only in one Member State, namely in Italy. However, a cancellation fee for access to poles seemed to be less common than for access to ducts. Only 2 NRAs (BNetzA and ComReg) indicated that the tariff included a cancellation fee. Finally, all but 2 responses noted that additional fees for wholesale regulated poles' access are imposed for the SMP operators PI. It should be mentioned that there are different approaches between additional fees and one-off charges observed, similar to the case of ducts. Details of the one-off charges, the additional fees, as well as the recurrent charges for access to poles for the NRAs that provided a full answer are summarized in table AII.33 of Annex II. Based on the analysed information, BEREC can notice, yet again, that the price level and pricing structure vary considerably between countries.

4.3.3. Cost models used for regulation of physical infrastructure elements

When asked which type of cost models[51] were used to set prices for access to the SMP operators' PI, BEREC noticed that the use of top-down and bottom-up models was evenly split among the NRAs. Out of 18 responses received, 8 indicate that a top-down model was used, while 8 responses pinpointed the use of a bottom-up model. In Ireland, there was a combination of the two, with a bottom-up methodology used for non-reusable assets and a top-down methodology for re-usable assets. At the same time, BIPT indicated that prices were set based on a fair and reasonable methodology that allowed a reasonable margin.

As regards the cost base established for the recovery of costs, current costs were indicated in 12 responses (63% of the total), while the rest chose the historical costs approach. Then, the most commonly used cost standard was the one of fully distributed costs (9 NRAs), followed by LRIC+ (6 NRAs) and LRAIC+ (4 NRAs). The breakdown of the answers is showed in table AII.34 of Annex II[52].

Finally, BNetzA indicated that the effects on the SMP operator's business plans are also taken into consideration for newly build VHCN infrastructures in the duct segment closest to the customer.

4.4. Transparency related to wholesale access to physical infrastructure

This section describes how the transparency remedy was implemented in those countries where SMP regulation is imposed for access to PI. Of particular interest is how the SMP

[50] NRAs which imposed cost-oriented pricing regulation for poles were OCECPR, EETT, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, ComReg, AGCOM, ECPTRA, AKOS, ARCEP and UKE; NRAs that did not establish cost-oriented pricing were HAKOM, RRT and AKEP.

[51] For a comprehensive overview of pricing/costing decisions see also the BEREC Rregulatory Accounting in Practice Report 2024, BoR (24) 166: https://www.berec.europa.eu/en/all-documents/berec/reports/berec-report-regulatory-accounting-in-practice-2024 .

[52] With ComReg being counted under the two categories included in the table.

transparency remedy is combined with the symmetrical obligations of the Broadband Cost Reduction Directive (BCRD), which also contains measures on transparency.

Amongst the transparency remedies, the database or (online) tool providing information on the PI (such as maps, occupation information etc.) coincided most with the requirements in the BCRD. In the 17 countries where a database/online tool providing information was imposed on the SMP operator[53], a majority of these systems was, either partially or fully, implemented by a separate system from the Single Information Point (SIP) on PI in the sense of Art. 4 of the BCRD. Table AII.35 in Annex II shows the division. This may imply that a majority of NRAs considered that the SIP in their country did not provide enough transparency and, therefore, further regulation was deemed necessary in this regard when competition problems were found.

When the online tool or database was provided by the SMP operator (either SIP or own system), the implementation costs were mostly paid by the access seekers, either by (recurrent) contributions to access the database/tool or by incurring these costs as part of the access fees to the PI. Only 2 NRAs (AK and AKOS) out of the 11 NRAs[54] under whose jurisdictions a tool was set up by the SMP operator indicated that the associated costs had to be borne by the SMP operator. Details are presented in table AII.36 of Annex II.

The BCRD provides for an obligation applicable to all network owners to make available, upon request, the minimum information on PI, which encompasses location and route, type and current use of the infrastructure, as well as a contact point. Complementary information offered by an online tool or database implemented to resolve the competition problems pinpointed by the relevant market reviews therefore could include geographical maps with the location, occupation level, technical specifications, state of the infrastructure or a reference offer. To that end, in countries where the SMP regulation on PI is imposed, a database or (online) tool providing information regarding ducts is required in 16[55] of the 17 countries concerned, followed by manholes (14 NRAs[56]) and then poles (11 NRAs[57]).

Respondents were also asked about the types of information and functionalities included in this database or (online) tool. The complementary information that was provided in most cases was geographical location of the concerned civil infrastructure (in a map format), followed by the provision of a reference offer or access modalities and technical specifications, such as, for instance, diameter of ducts. Almost all these complementary pieces of information were provided based on SMP regulation. Further details on the specific data corroborated with the PI elements it refers to are shown in tables AII.37 (from a to d) from Annex II.

Regarding the functionalities of the imposed online tool or database, in half of the cases the information has to be available in real-time (as opposed to “available upon request” which was the minimum requirement of the BCRD). BEREC discerns that this ‘real-time data’ functionality, in about half of the systems that supported it, was provided either by the BCRD or a combination of BCRD and SMP regulation. Furthermore, in more than half of the cases, the online tool also offers PIA requests functionality (mainly based on SMP regulation).

In many cases, information on the occupation level has also to be provided by the SMP operator, and several regulators have stipulated provisions to ensure this. For example, ANACOM obliged the SMP operator to provide indicative information on duct occupation using a 4-level colour system. Another 4 NRAs[58] provided that the SMP operator should publish general rules on availability and/or reserve needs (e.g. in its reference offer), while other

[53] By AGCOM, AKEP, AKOS, ANACOM, AK, Arcep, BNetzA, CNMC, ComReg, EETT, ECPTRA, HAKOM, OCECPR, RRT, RU, SPRK and UKE.
[54] AGCOM, AKOS, ANACOM, AK, ARCEP, CNMC, ComReg, ECPTRA, HAKOM, OCECPR and SPRK.
[55] AGCOM, AKEP, AKOS, ANACOM, AK, ARCEP, BNetzA, CNMC, ComReg, EETT, ECPTRA, HAKOM, OCECPR, RRT, RU and SPRK.
[56] AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC, ComReg, EETT, ECPTRA, HAKOM, OCECPR, RRT, SPRK and UKE.
[57] AGCOM, AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC, ComReg, HAKOM, OCECPR and UKE.
[58] AGCOM, AK, ComReg and EETT.

regulators (ANACOM[59], HAKOM[60], OCECPR[61], UKE[62]) had themselves established rules in this regard. In France and Italy, the access seekers also had to provide information to keep the database or tool up-to-date. In Latvia, the SMP operator was obliged to provide pictures of manholes when they were opened.

Based on the information provided above, it can be concluded that, in a lot of cases, NRAs use the transparency remedy in SMP regulation to allow for increased information availability regarding the PI (such as an accurate location using geographical maps, occupancy level, duct section, technical details or a reference offer) and functionalities (e.g. a directly available online tool to submit access requests) to complement the minimum information that should be made available according to the BCRD and, forward-looking, GIA. Clearly, the main aim of these obligations is to enhance take up by access seekers and spur the competition in the market at its most upstream level. While the GIA will provide for further digitalisation of the SIP and geographical referencing, SMP regulation may still be needed in the future for the other supplementary information or the manner by which information on PI is required to be provided, should these data be deemed necessary for a more effective access and take-up of high-speed broadband services.

4.5. Quality of the SMP operator's physical infrastructure access offer

14 NRAs[63] out of 28 that answered this section required a complete list of specific parameters associated with the provision of PIA by the SMP operator in its reference offer. By contrast, many NRAs did not require such a list because in several countries PIA was not regulated.

In figure 2 below, BEREC shows whether NRAs imposed a certain quality level through SLAs or service level objectives (SLOs). Where this was the case, it was highlighted whether they were set either in the NRA's decision/in the SMP's reference offer or through different means. Finally, the graph below shows the NRAs that required KPIs to monitor the quality of services related to regulated access to the respective PI. Table AII.38 in Annex II shows the breakdown by NRAs with positive answers to the relevant questions.

[59] ANACOM defined a formula to calculate the free space in a duct, which amounted to the difference between the total space of the duct and the occupied space. The total space was achieved through the following formula: π x R2, where R = Diameter conduit or subconduit/2. The occupied space of the conduit/sub-conduit corresponded to π x (Dpipe/2)2, where Dpipe could be found from the formula available in ANACOM's decision of 25.06.2006, available at: https://www.anacom.pt/render.jsp?contentId=370426&languageId=1.

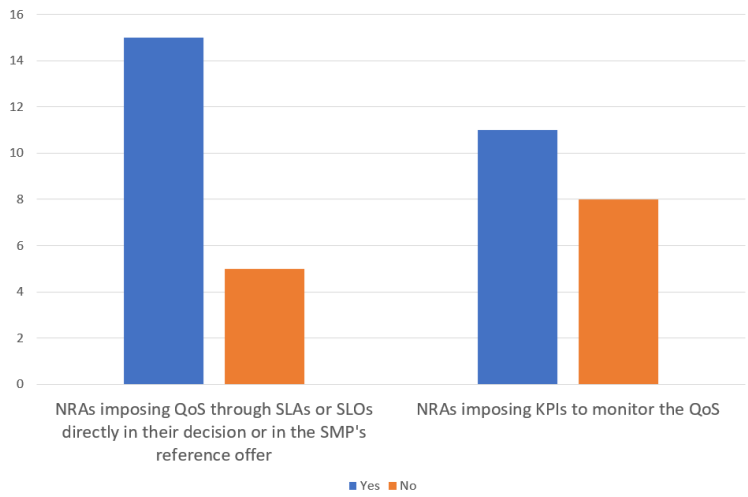
[60] In Croatia, an ordinance defined how to calculate the available space in ducts, based on the cables and ducts size. There was an obligation to offer all available space, with no reserved space allowed.

[61] In Cyprus, a mathematical formula was defined that estimated the maximum diameter of the cable that could be deployed in a duct, based on duct size and existing cables. The owner might reserve 25% of the duct for repairs, maintenance or further deployments.

[62] In Poland, reserved needs of the owner of the PI should be demonstrated by submitting timetables of planned investments.

[63] ComReg, AK (the reference offer contains all information on the offering of passive fibre, ducts/pipes and services related to central offices), SPRK, NMHH, CNMC, BNetzA, HAKOM, ANACOM, RU, ARCEP, UKE, ECPTRA, AGCOM and EETT (infrastructure access reference offer was not been published yet).

Figure 2: Quality of service obligations related to regulated PIA[64]



For most NRAs, the most important KPIs were related to the effectiveness of access and especially focused on elements such as provision time (for instance, in the case of DE, ES, HU, LV and PT). They may also concern fault repair times. In terms of periodicity, most NRAs required the SMP operator to provide those KPIs quarterly[65], while ARCEP required the provision of KPIs monthly and SPRK twice a year.

Another noteworthy point is that one NRA (ARCEP) stated that it required separate KPIs for the PI built in the context of the legacy networks (typically, services based on copper) and for the next generation networks (if relevant and different elements of the PI were used for the purpose of the network rollout).

Finally, most NRAs requiring KPIs implemented penalty mechanisms in case of non-compliance, in countries such as CY, LV, HU, ES, DE, PT, HR, FR and PL.

5. Regulatory measures relating to physical infrastructure access for incentivizing VHCNs rollout

This chapter firstly examines NRAs' experiences with the two regulatory approaches, asymmetric and symmetric, to PIA in the rollout of VHCNs. The asymmetric regulation concerns regulated access of telco operators designated with SMP, typically the fixed line incumbent(s) that will generally have the most extensive nationwide telco infrastructure network, that alternative operators may seek access to while deploying fibre as part of the expansion of their own networks. The experience with the asymmetric approach is covered in section 5.1. The symmetric regulatory approach covers regulated access to all infrastructure, both telco and non-telco, for the use of all network rollout and, as such, is not limited to operators designated with SMP. Depending on the PI, symmetric access obligations could have been imposed either according to the EECC's provisions (Art. 61) or under the BCRD. Such experience is evidenced in section 5.2. Finally, section 5.3 provides some further insights into how NRAs view the interplay between symmetric and asymmetric regulation to achieve the general connectivity goal related to fibre deployment.

5.1. Asymmetric regulation

This section explores the outcomes of past SMP regulation for PIA on the consumption of PI for the rollout of VHCNs. The issues raised here are closely linked to the pricing remedies

[64] The NRAs imposing QoS for PIA are showed explicitly in table AII.38 in Annex II, while the NRAs not imposing QoS through SLAs or SLOs are NKom, ECPTRA, BIPT, AKEP, MCA and the NRAs not imposing KPIs are NKom, BIPT, AKEP, MCA, RRT, RU, AGCOM and AKOS.

[65] OCECPR, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg and UKE.

discussed in the section 4.3. In a nutshell, focusing in particular on the NRAs' notifications of the past 3 years, in the case of countries that imposed remedies related to PIA, BEREC enquired about the number of VHCN operators and whether remedies had an impact on this number, the status of the rollouts based on the SMP operator's PIA regulated offer (i.e. information on the take-up and reception of PIA remedies) and the pertinent VHCN deployment developments (including whether there were complaints and disputes that included access to PIA, whether changes to remedies were considered by the NRAs etc.).

23 out of the 29 NRAs that took part in BEREC's survey gave a reply on whether they imposed PIA remedies on one or more telco operators in any market review that was either at least 3 years old or had happened further away in the past. 13 of these indicated that they assessed such issues in the current market reviews[66], 4 mentioned that they imposed PIA remedies in some format in the past reviews only and the remaining 6 NRAs stated that no specific SMP-based PIA remedy applied to any market. Table AII.39 in Annex II breaks down the responses of the 17 NRAs that imposed PIA SMP remedies in their current or past market reviews.

At the same time, asked which were the markets that included PIA, in consideration of the recent market reviews, 5 NRAs imposed PI obligations in the WLA market and another 4 in a standalone PIA and/or WDC market reviews. The details on NRAs' individual answers are included in table AII.40 of Annex II. Furthermore, the 8 NRAs[67] were also asked about the number of VHCN operators competing with the SMP operator in the relevant market that access to PI was a remedy in. As it can be seen in detail in table AII.41, there was a wide spread of competing VHCN operators, from under 5 competitors (in 2 countries) to over 100 competing operators (in other 2 countries)[68].

The 17 NRAs were asked about the number of operators designated with SMP to whom PIA remedies were imposed, irrespective of the timing of the previous market review. From the 13 NRAs (76%) that responded to this question, all with one exception noted that the SMP designation related to only one operator (table AII.42).

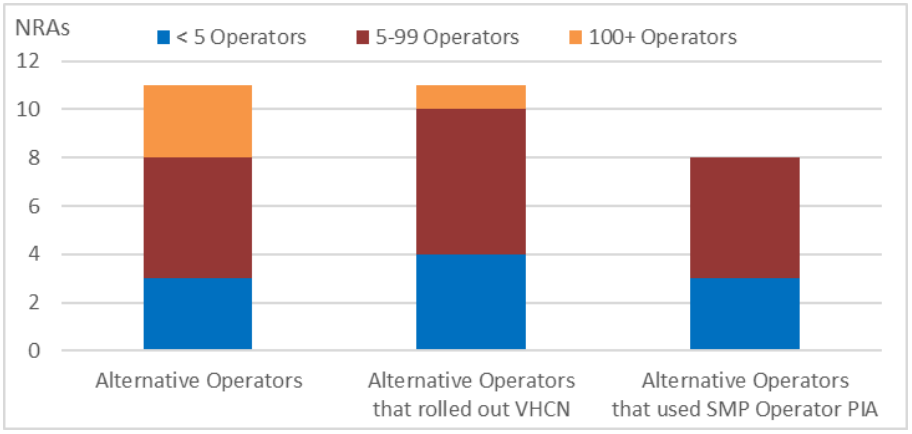
Looking at the demand for the SMP operator's PIA, figure 3 below details the interplay between the number of alternative operators present in the markets under assessment and the usage of access to SMP regulated PI. It can be emphasized that the same number of countries (11) feature alternative operators that did invest recently in VHCNs and others who did not. Overall, the number of countries (8) and the number of alternative operators in those countries making effective use of the PIA remedies is relatively lower than those rolling out VHCNs without using SMP-based PIA. However, it is noteworthy that the majority of alternative operators did make use of regulated access to PI. At the same time, regarding the number and probable network reach of the operators in the countries surveyed, the higher the number of smaller operators in a country, the less likely was for them to be in need of regulated PIA at national level, especially when their networks' coverage was local and/or regional.

[66] 'Current' in the understanding of this report needs to be read as not being older than 3 years.

[67] OCECPR referred to PIA regulation under both WLA and WDC markets.

[68] There is a limitation to this question and, correspondingly, the answers received in that the size of these operators is not known.

Figure 3: Interplay between the number of alternative operators, investments in VHCNs and demand for the SMP operator's PIA[69]



15 of the 17 NRAs that imposed specific obligations related to PIA provided information on the use of the SMP operator's PIA beyond the rollout of VHCNs. 9 NRAs stated that the SMP operators PIA was solely used for the deployment of VHCNs. 6 NRAs indicated that it was also used for other purposes. Those NRAs gave some examples of uses, such as own needs, deployment of transport fibre/leased lines/capacity, deployment of ad hoc dedicated capacity links for end users but also for connecting nodes in networks of alternative operators, FTTC network deployment and/or for mobile and coaxial networks. BEREC sees that most of the examples provided can actually be linked to the deployment of VHCNs[70], demonstrating that, indeed, PIA regulation may be beneficial and useful for boosting VHCNs rollout.

Based on the data collected, BEREC shows in figure AII.43 of Annex II the share of the SMP operators' PIA that has been rented or leased. 10 NRAs provided the share of duct rental, as follows: 6 NRAs reported duct rental of less than 20% and the other 4 reported rental between 20 and 100%. 6 NRAs responded with shares of pole rental and 5 reported less than 10% of the SMP operator's poles were rented out, while one NRA had a share between 20-49%.

In terms of the number of complaints concerning access or the delivery of the SMP operator's PIA products received by NRAs in the last years, 5 NRAs reported none, 4 noted less than 5 and the remaining 3 said that they had received more than 5, with just one mentioning more than 10. When asked about the number of serious complaints made by the alternative operators, the registered numbers were lower, with 6 NRAs having reported less than 5 complaints and one having declared over ten[71].

Finally, asked if the NRAs had made any significant changes to the PI access regime in the last 3 years due to the changing market circumstances or to a potential need to adapt because of changes in the competitive scenery, out of the 8 NRAs that responded to this question only 2 (AGCOM and ANACOM) stated that there were significant changes, which related to pricing.

[69] **Alternative operators:** "<5 Operators" (AKOS, NMHH and OCECPR), "5-99 Operators" (ANACOM, ComReg, RRT, ECPTRA and HAKOM), "100+ Operators" (AGCOM, NKom and SPRK); **Alternative operators that rolled out VHCN:** "<5 Operators" (AKOS, BIPT, NMHH and OCECPR); "5-99 Operators" (AGCOM, ANACOM, ComReg, ECPTRA, HAKOM and SPRK); "100+ Operators" (NKom); **Alternative operators that used SMP operator's PIA:** "<5 operators" (BIPT, RRT and NMHH), "5-99 Operators" (AGCOM, ComReg, ECPTRA, HAKOM, AK and SPRK).
[70] For clarity, the concept of VHCN has to be understood as meeting the thresholds detailed in the BEREC Guidelines on very high capacity networks (BoR (23) 164 - https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-on-very-high-capacity-networks-2023).
[71] **Total complaints:** "0" (AGCOM, RRT, HAKOM, AK and UKE), "1-4" (ANACOM, ComReg, ECPTRA and NMHH), "5-9" (NKom and SPRK), ">10" (CNMC); **Significant complainants:** "0" (AGCOM, RRT, HAKOM, AK and UKE), "1-4" (BIPT, ComReg, ECPTRA, NKom, NMHH and SPRK), ">10" (CNMC).

5.2. Symmetric regulation

Asymmetric and symmetric regulation may, intertwined, play a significant role in providing better competitive outcomes, by way of ensuring the right incentives for operators to supply their services at a good quality, for an affordable price to the end-users. The BEREC questionnaire aimed to assess the extent to which NRAs across Europe are utilizing symmetric regulatory measures, primarily through the BCRD (and, further-looking, GIA), to encourage greater use of existing PI. The possibility to provide feedback on symmetric access to in-house wiring and cables is covered too[72].

A total of 25 NRAs (out of the 29 in total) responded to the questions concerning the implementation of symmetric regulation, both under the EECC and BCRD. Their responses are summarized in table AII.44, of Annex II. 15 NRAs indicated that symmetrical regulation regarding access to PI and/or wiring and cables had been imposed in their countries, with 6 under the provisions of the EECC and 11 under national laws or BCRD . Out of these, 4 NRAs stated that the regime was set only under Art. 61 EECC[73], another two NRAs (EETT and HAKOM) reported imposition under Art. 61 EECC and under another regime[74], while 9 NRAs mentioned another regime only. On the other hand, 8 NRAs had not imposed symmetrical regulation, and two NRAs (ComReg[75] and NKom) were considering that possibility at the time of the survey. Below, BEREC provides details on the obligations imposed under a symmetrical regime across certain countries.

- In AT, for instance, based on the national law implementing Art. 3 of the BCRD, access to passive PI (ducts, dark fiber) is imposed through case-by-case decisions. In the same vein, cost orientation is embedded as a principle.
- In LV, symmetric access to ducts was adopted under the European telecommunications framework since 2014.
- In FI, according to the Act on shared construction (the national implementation of the BCRD), the communications and electricity network operators, as well as water supply and transport network operators, are obliged to give access to their PI on fair and reasonable terms at the written request of another network operator.
- CZ has in place symmetric regulation stemming from BCRD, the scope of obligations being based on fair, reasonable and non-discriminatory terms and access conditions, including as regards pricing. In case of disputes, the price must be cost-oriented, taking into account the business plan of the regulated entity.
- In SE, PIA is imposed only under BCRD and its implementation in national law. So far, no case concerning the level of access prices was brought forward.
- In ES, CNMC adopted a decision in 2009 that held that the first operator deploying the fiber local access segment within a building[76] had to make it available to third parties at reasonable prices. Besides access and price control (reasonable prices) obligations, the measures contained specificities on transparency. The decision was adopted based on the national law provisions, that were similar but not identical to the current Art. 61 EECC.
- For DE**,** it was reported that the dispute settlement body solves disputes as per the provisions of the national law stemming from the BCRD implementation, which may involve different procedural measures:

[72] Please note that BEREC's question made reference to Art. 61 in general and not to a specific paragraph of it. Therefore, at times, it cannot be fully inferred whether the basis was Art. 61 paragraphs (1) and (2) or paragraph (3) specifically addressing the access to in-house wiring.
[73] Not necessarily with reference to in-house wiring and cables (Art. 61(3)).
[74] This other regime was typically related to the BCRD or the national law preceding the BCRD in certain countries. However, those national laws had similar goals as the BCRD.
[75] ComReg has powers to officiate disputes under the transposition of the BCRD, however, no service provider has invoked it yet.
[76] The segment of an NGA access network which connects an end-user's premises to the first distribution point.

- for determining the shared use of public supply and telco networks including the charges for shared use (section 138 TKG[77]),
- on transparency concerning passive network infrastructures including on-site surveys of their suitability (sections 136 and 137 TKG),
- on information about construction work of public supply networks (section 142 TKG),
- on the coordination of civil works with respect to the rollout of elements of the digital high-speed telco networks and the shared use of infrastructure (section 143 TKG), and
- on the shared use of in-building network infrastructure including charges for the shared use (section 145 TKG).

Cost orientation principle can also be applied.

Other examples include:

- PT, where the national law transposing BCRD foresees that access to PI is to be offered in a transparent, non-discriminatory, cost-oriented way.
- In HR**,** symmetric regulation is imposed under the national implementation of Art. 61, which stipulates that each operator deploying FTTH networks must provide access at the distribution node[78]. The principles of non-discrimination, open access with equal conditions, including price need to be guarded. Besides access at the distribution node, access obligations can be imposed at a higher point in the operators' network[79], if the access seeker cannot economically replicate the network up to the distribution node. On the other hand, based on national implementation of BCRD, all operators deploying PI which can be used for deploying VHCNs are obliged to provide access on equal terms as regards transparency, non-discrimination, openness and price. The PI inside the buildings is also subject to the abovementioned symmetric obligations.
- In IT**,** symmetrical regulation has been imposed under Art. 61 of EECC, again including transparency, non-discrimination and fair and reasonable pricing obligations.
- In EE, symmetrical regulation has been imposed under BCRD.
- In FR, ARCEP imposes several obligations, including transparency, non-discrimination and reasonable prices, to all operators rolling out FTTH. Operators must give access to their network at a concentration point whose location varies depending on population density.

5.2.1. Influence of symmetrical regulation on the results of market analyses

Among those NRAs which reported symmetrical regulation in place (be it under EECC or national law/BCRD), 5 NRAs[80] provided details about how it is considered and its impact on the results of the market analyses for the PIA, WLA, WCA and/or WDC markets. Specifically, as per the information presented below:

- SPRK reported that the imposition of symmetrical regulation had a positive influence on competition in the relevant markets. Since alternative operators had mainly deployed overhead optical fiber cables connecting roofs of the buildings, symmetric access was an important additional tool to support competition where necessary. Due to the aesthetic and safety reasons, incentives to remove overhead cables are underway by local and national authorities, especially in the historical center of Riga. The process is long and complex involving the Court, as well. Therefore, the regulation of the PI will play a greater role in the future.
- In CZ, access to PIA was considered as a possible remedy in the WLA market, but finally it was not imposed because existing PIA stemming from BCRD symmetric

[77] The German telecommunications act.
[78] The node where the last splitter of PON FTTH network is located.
[79] Further away from the end user.
[80] SPRK, CTU, CNMC, ANACOM and HAKOM.

regulation was considered sufficient. Regarding the WCA and WDC markets, no SMP was found and, thus, no room for PIA imposition was identified.

- In ES, the influence of imposed symmetrical regulation on WLA market was reported. Access to the fiber local network available within buildings was excluded from the scope of SMP regulation, as it was already covered by the symmetric obligations imposed by CNMC in 2009.
- In PT, symmetrical regulation just complements the access under SMP PIA and no particular impact on neither WLA, WCA or WDC was found.
- In HR, the existence of symmetrical obligation for access at the distribution node and for access to PI was one of the reasons for deregulation of the non-competitive areas of the high-capacity market[81], in the WLA and WCA markets. Symmetrical regulation in HR has a positive influence because it allows alternative operators to deploy their own networks without expensive duplication of the needed elements. Regardless of existing symmetrical PIA obligations, HAKOM, under last WLA market analysis, decided for duct access obligations to the SMP operator to be able to impose cost-oriented prices for duct access. Although HAKOM is currently in the process of new round of market analysis of the WDC market, it can already be concluded that symmetrical obligation for PIA had a positive influence on the said market, since, as mentioned, it allows alternative operators to deploy their own networks without the need for network duplication.

Considering the scarce feedback to this question, it may be too early to clearly determine whether regulatory experience to date suggests that symmetric regulation on PI elements and/or in wiring and cables could be sufficient to resolve the identified competition problems on its own. Nor is it possible to make an argument, at this juncture, that the need for asymmetric obligations on PI has been made redundant, as several countries find the SMP regime appropriate for establishing pricing obligations, for instance.

5.3. Interplay between symmetric and asymmetric regulation of physical infrastructure access

This section sets out the views of NRAs regarding the current and prospective interaction between regulating access to PIA via *ex ante* asymmetric regulation and the symmetric access obligations contained in the Broadband Cost Reduction Directive and the Gigabit Infrastructure Act (BCRD/GIA)[82].

In this regard, NRAs were asked about (i) market outcomes as a result of imposing SMP remedies on access to PI, (ii) the prospects of existing obligations currently imposed via *ex ante* regulation being lifted on the basis of the sufficiency of application of BCRD/GIA and, finally, (iii) the key elements that may be absent, in NRAs' views, in the event that *ex ante* regulation were to be lifted.

A significant number of NRAs that responded to this part of the questionnaire (9 NRAs out of 11 in total) highlighted the importance of access to passive SMP infrastructure for the promotion of high-speed network deployments in their countries. However, in 2 countries, the BCRD had been seen as the most efficient instrument for ensuring the availability of access to PI elements. Table AII.45 in Annex II provides further details. Some of the NRAs not included in the table have also provided more information in the form of additional comments and thoughts. For example, in Liechtenstein, the fostering of competition in the market had taken place mainly via regulated access to the copper and fiber local loops and backhaul fiber, with only limited demand for access to PI. At the same time, several NRAs deemed that it was too early to assess the impact of imposing SMP-based remedies on the market outcomes or

[81] The high-capacity market in Croatia is defined as comprising fibre and cable.
[82] Due to the limited usage of ex ante symmetric provisions according to the EECC, as well as to their link with the in-building PI, this question referenced only symmetric regulation under BCRD/GIA or similar national laws.

noted that not enough information was available to provide a fully-fledged answer to the question, e.g. because of limited take-up of the SMP operators' PIA by alternative operators[83].

Being asked about the perspectives of PIA regulation and whether the GIA would be the right tool to address competition problems related to wholesale access, most of the respondents to this question (11 NRAs) consider that, for the time being, the BCRD/GIA are deemed a complementary or subsidiary instrument to SMP regulation (see tables AII.45 and AII.46). Responding NRAs point to factors such as:

- the fact that access under the BCRD/GIA does not address the perceived market failures in the same way as access obligations under the SMP regime (BNetzA),
- the importance of setting cost-oriented prices (HAKOM),
- the fact that *ex ante* regulation is a better framework for the concrete definition of the access regime regarding elements such as pricing, reference offer or SLAs (BIPT),
- the risk of delaying tactics by the incumbent operator with regards to the negotiation of access prices that is better tackled through asymmetric means (AKOS),
- the absence of a parallel infrastructure network that can compete in terms of coverage and granularity with the network of the incumbent operator (ARCEP and AGCOM) or
- the fact that measures under the BCRD/GIA do not have the same scope, level of detail and intensity as the measures that may be adopted under the *ex ante* regulatory regime, in particular with regards to elements such as procedures, level of transparency (e.g. mandatory availability of duct occupation information), KPIs, SLAs and SLGs or pricing (e.g. cost orientation) remedies (ANACOM).

On the other hand, some NRAs have a more nuanced view on whether the BCRD/GIA might prove sufficient to ensure the availability of access to PI now and/or in the future. Some of the key elements that may justify lifting of *ex ante* obligations, as specified by the NRAs, include:

- streamlining the procedures specified in symmetric secondary legislation (OCECPR),
- ensuring that the transparency mechanisms set in the symmetric legislation address the needs of the market (NKom[84]),
- the role that access to the PI of public administrations may play (ANCOM) and
- the importance of looking at the state of retail broadband competition before deciding on whether SMP-related measures on the wholesale markets are still necessary (AKEP).

In any event, these NRAs noted that a thorough analysis of the implied elements needs to be undertaken before adopting any decision in this regard.

Finally, concerning what pertinent tools to address competition problems could be missed if *ex ante* regulation was lifted, some of the main issues highlighted by NRAs include:

- A decreased level of transparency in comparison to the availability of the online tool provided by the incumbent, which facilitates shorter and more efficient timing for access (SPRK),
- SMP regulation ensures the availability of a fully functional access offer, whereby the procedures and technical conditions for access are clearly established, together with the predictability of the access and price conditions (CNMC),
- The importance of imposing cost-oriented prices regarding access to the incumbent operators' PI, as well as additional measures regarding transparency/non-discrimination, such as SLAs etc. (ANACOM, ARCEP, BIPT, HAKOM and NKom),
- The increased risk of access refusal (AGCOM and ARCEP),
- An increase in the number of disputes if critical aspects of the SMP regime such as increased transparency and non-discrimination were not applicable (AKOS),
- Potential degradation of the quality of service (ARCEP),

[83] EETT, NMHH, BNetzA, HAKOM, ANCOM, BIPT, AKOS and AKEP.
[84] NKom however notes that, where there is a risk for excessive pricing, *ex ante* regulation is still likely to play an important role for imposing a proportionate price regulation regime.

- The flexibility of *ex ante* regulation when compared to other instruments that may be applied, such as *ex post* competition law (ANACOM).

In BEREC's view, all the above indicates that both symmetric and asymmetric regimes need to go hand-in-hand as regulatory tools for NRAs to resolve the competitive problems identified in their national markets. As such, these instruments may be broadly seen as complementary and, depending on the national circumstances, one may prevail over the other. In some instances, it is too early to assess the full extent on the relevant markets considering that some of the measures may have been quite recently adopted. Also, BEREC notes a limited use (3 NRAs[85]) of the EECC provisions under Art. 61 for regulating access to PI and/or wiring and cables for the provision of fixed services ex ante in a symmetric setting.

6. Expectations for the future

Since all market reviews have an inherent forward-looking component embedded and since various challenges related to the functioning of the traditional electronic communications markets are expected ahead, BEREC asked the NRAs to describe the main challenges they foresee regarding future PIA regulation. The most interesting insights are divided in the following sections describing (i) the broader picture, (ii) the specific legal and operational challenges, as well as (iii) a couple of longer-term perspectives.

6.1. Broad challenges identified

As regards an overview of the broad challenges identified by the NRAs in their answers, most of NRAs highlighted difficulties that they had with properly defining a PIA that would be regulated adequately. **ECPTRA** said that as PI building and deployment was very expensive, the PIA market may be considered the most important *ex ante* regulated market. **AKOS** deemed it a challenge to establish a competitive wholesale PIA market. **AK** identified the potential lifting of *ex ante* regulation of PIA as a challenge to ensure future access and added that PIA regulation would in fact streamline measures, taking due account of the fact that telco infrastructure still has the characteristics of a natural monopoly. **AKEP** also identified challenges with having a clear overview of PIA owned by municipalities and non-telco utilities. **ANACOM** mentioned challenges related to the regulation of non-telco infrastructure. A similar stance was taken in **RRT**'s[86] response as well.

By contrast, **ARCEP** already defined a separate PIA market. The latest decision, adopted in December 2023, aimed at tackling two main changes anticipated for the next years. The first one was the need to finalise quickly fibre rollouts, with a focus on the last segment. The second was the move to a situation where the fibre network was completely rolled out and copper had been switched off[87]. This second change requires, in ARCEP's view, on the one hand a new focus on maintenance, and on the other hand a more detailed monitoring of the non-discrimination obligations.

Finally, a couple of NRAs mentioned that there is room for thinking into how to balance the incentives for operators to network deployments in the context of imposing *ex ante* regulation of PIA.

6.2. Operational and legal challenges

Several NRAs treated the topic of **the adequacy of the BCRD/GIA** in settling the competition issues identified by NRAs in their market reviews. Some NRAs[88] underlined that SMP-based

[85] OCECPR, AGCOM and ARCEP.
[86] RRT further pointed to some specific challenges of defining PIA as a separate market, such as data collection from all the relevant players in the market or details of the substitutability analysis realisation in the national circumstances.
[87] i.e. from a "one network owner" in the copper world to a situation where Orange's PI were used in some areas mostly by Orange (for FttH) and in some areas mostly by another operator (again for FttH)
[88] ANACOM, ARCEP, BIPT, BNetzA and ECPTRA.

regulation may be the most appropriate to ensure a proper regulatory oversight of matters concerning PIA, such as pricing and ensuring fair access. To this effect, GIA would not, on its own, be sufficient to address these matters efficiently.

On the one hand, **ANACOM** said that the GIA is expected not to be sufficient to address the business protection of the alternative VHCN operators that need to have access to SMP PI to host their networks. **ARCEP** also mentioned that there are some limitations as to the applicability and effectiveness of GIA to address specific market circumstances concerning PIA, when implemented on its own. At the same time, **BIPT** said that, when access to ducts is deemed necessary, *ex ante* regulation is a better framework for the concrete definition of the offer itself (e.g. pricing, reference offer, SLAs etc.) rather than GIA. BIPT added that, so far, it has not identified grounds to lift *ex ante* regulation in favour of GIA/BCRD and that PIA under the BCRD is hardly used in Belgium. **BNetzA** mentioned that the access obligation had been imposed only recently, because some access obligations under the BCRD were already in place. However, BNetzA noted that this access did not address market failure in the same way as the SMP-based access obligation, the latter being more comprehensive.

On the other hand, a number of NRAs reported the imposition of symmetric regulation based on the BCRD (including at times the outcomes of such regulation), but without having identified shortcomings with respect to SMP-based regulation. **ANCOM** said that if the use of PIA owned by non-telco operators (such as in the case of local administrations) will increase in the future, then the application of symmetric regulation according to GIA may be one of the workable options. However, it also noted that further assessment was needed. **CTU** mentioned that, despite PIA having been considered as a possible remedy under the WLA market assessment undertaken, the imposition of PIA in an asymmetric setting was finally considered disproportionate, in view of the symmetrical regulation already in place. **HAKOM** considered that the existence of symmetrical access obligations at the distribution node was one of the reasons why certain relevant markets could be deregulated (i.e. the non-competitive areas of high-capacity market in WLA and WCA). **NKOM** said that it has imposed symmetric regulation based on BCRD, but without establishing specifics on pricing that go beyond a requirement for pricing to be fair. Symmetric regulation based on BCRD has not yet influenced market analysis and/or remedies in Norway. **PTS** reported that it has imposed PIA only under BCRD and that, so far, there have been no cases concerning the level of access prices. **RTR** mentioned that, in Austria, PIA is not regulated based on a market analysis. Regulation of access to passive PI (ducts, dark fiber) is decided case by case, based on symmetrical provisions in the national law mirroring Art. 3 of BCRD. In Austria's case, no standardized obligations have been established, but cost orientation is considered as an established principle. **SPRK** also considered that symmetric access is an important additional tool to support competition where necessary and that regulation of the PI will play a greater role in the future.

Additionally, one NRA (**CTU**) underlined that one of the most important challenges (from the legislative and technological point of view) will be the implementation of Art. 12 GIA concerning digitalization of the SIP.

Besides views expressed relating to the BCRD/GIA regulation, some NRAs pointed out challenges related to the operational aspects of PIA concerning (i) access to in-building wiring, (ii) pricing and ensuring fair access, (iii) dispute settlement, as well as (iv) data availability and processes' harmonization.

With respect to **access to in-building PI**, several challenges have been identified, with countries that have had problems dealing with them in different ways. For instance, **CNMC** said that access to in-building infrastructure was covered by specific legislation. **AKEP** and **ECPTRA** identified challenges with PI access in the buildings, with ECPTRA having imposed access obligations under the BCRD and AKEP suggesting the need for *ex ante* asymmetric regulation in that regard. **HAKOM** stated that the regulation of access to in-building PI was not in force on telco operators when they carried out the market analyses.

The aspect of **fair access and price conditions** has been outlined as a specific challenge in the future. **CNMC** mentioned the importance of ensuring a widespread availability of PIA, which is a key element for VHCN deployment, via fair access and price conditions. **COMREG** said that for PIA use to be effective it requires that access seekers have effective and efficient access at an operational level, so they can plan their use in advance and make the case for investment. COMREG also suggested that consideration could be given to calculating a specific WACC for PIA given the different risks applicable to PIA demand and revenues. **PTS** mentioned the challenge of assessing fair and reasonable prices, noting that this could involve time-consuming, case-by-case evaluations that might create uncertainty and potentially impact investment incentives. **NMHH** mentioned challenges related to ensuring cost orientation in the future regulation of PIA, while **AKOS** referred to changing the mindset of infrastructure owners to view PIA as a revenue opportunity and balancing joint use of infrastructure with redundancy for resilience.

Dispute resolution procedures seem to represent a challenge for some NRAs in the future, especially since their degree of complexity is expected to grow. **HAKOM** identified the regulation of non-telco infrastructure and the consolidation regarding access to in-building infrastructure as main areas of concern in view of dispute resolution. **ANCOM** referred to the high number of disputes under its remit over access tariffs to utility poles, while **ANACOM** mentioned the legal disputes over wholesale pricing. Additionally, in order to mitigate the effects of irregular occupations of PI, **CNMC** approved a resolution in November 2021 establishing a series of procedures aimed at regularising or uninstalling these irregular occupations, which vary depending on the situation of the operators acting improperly.

Data availability and the harmonization of operational processes has been brought to BEREC's attention as well. **CTU** mentioned the need for accurate data about PI (both telco and non-telco PI), as well as the complexities introduced by the emergence of wholesale-only operators. **BIPT** referred to challenges related to ensuring operational-level access to newly built ducts, including transparency regarding their location and availability, and dealing with obstructed ducts. **NKOM** mentioned the importance of improved harmonization of operational processes between operators, including capacity requests, contracts, ordering, operation and security. **NMHH** pointed to challenges related to determining the supply side and the update of the SIP in its answer.

Some other challenges mentioned included views expressed by **AKOS,** underlining the need to change the mindset of infrastructure owners to view PIA as a revenue opportunity, and **ARCEP,** mentioning challenges in the last segment of fibre rollouts and the operational issues with impact on network resilience related to the transition from poles and aerial infrastructure elements to underground infrastructure (mainly ducts).

6.3. Strategic and long-term considerations

BEREC notes two broad long-term considerations mentioned by a number of NRAs, one relating to the transition to maintenance-focused regulation, considering the utilization timespan of the concerned elements, and the other related to the impact of the emerging technologies which may change the market segmentation and focus, as we know it today.

As regards the **transition to maintenance-focused regulation, ARCEP** noted the future shift from regulations aimed at speeding up the rollout of fibre networks towards measures centred on maintaining the existing infrastructure. This paradigm change will bring about new costs and coordination needs, and therefore an even more challenging environment for the regulation of PIA in the French regulator's view.

In view of the **emerging technologies and market segmentation**, **AKOS** and **BIPT** discussed the need to adapt regulations to accommodate new technologies and potentially different market segmentation, in such a way as to ensure redundancy and resilience in networks. For instance, **AKOS** made reference to the need for balancing joint use of infrastructure with redundancy for resilience.

Overall, the questionnaire responses indicate that future PIA regulation will need to address an array of challenges, from balancing investment incentives to operationalizing fair access and managing emerging technologies. Additionally, the potential for disputes over pricing and the need for precise infrastructure data feature as relevant themes.

7. Conclusions

Throughout this exercise, BEREC collected a comprehensive series of data and information related to the regulation of PIA. The starting point of BEREC's activity was related to the recommended markets susceptible to *ex ante* regulation or markets that may warrant such a treatment under the national circumstances. However, BEREC has also sought insights into the data collection on PI from non-telco operators, very detailed aspects on the remedies imposed by PI elements, including the quality of the SMP operators' offer, as well as the interplay between asymmetric and symmetric regulation. In this context, it is worth recalling EC's 2020 analysis when the 2014 Recommendation on relevant markets was under revision during which the treatment of PIA was assessed from several angles by the EC's consultant[89]. On the one hand, PIA's importance as the most upstream market in the value chain of provision of electronic communications services has been clearly signaled at the time and ever since. In this sense, PIA regulation is undoubtedly seen as a cross-market remedy with impact on all the other specific markets that may be defined downstream of it and many countries in Europe do regulate PIA in some form or the other through asymmetric means. On the other hand, mandated PIA in countries with fragmented networks or unducted networks may not be appropriate. This is indeed what BEREC notices with respect to some countries in which the provisions of the national laws implementing the BCRD have been considered enough to assure effective competition, sometimes in well-defined geographic areas (by contrast to the typically national markets for PIA).

Furthermore, BEREC highlights the growing importance of defining a PIA standalone market, despite the number of NRAs who have done so being rather small to date. Considering the recent developments, 2 countries (IE and PT) from the 3 having issued decisions by July 2024 have done so in 2023, 2 more in the period from July 2024 to December 2024 (BG and LV), ECPTRA at the beginning of 2025 and CNMC planning to do so in the close future[90]. Therefore, despite the numbers being rather small, an increase of the pace with which NRAs deem PIA adequate to solve the competitive issues identified in their markets is increasing. Moreover, as rightfully pointed out by some NRAs, establishing specific obligations targeted at PIA proved to be an effective means for deregulation of other relevant markets, potentially geographically segmented.

Overall, BEREC pinpoints the importance of PIA regulation in an SMP setting, supported by the evidence from 20 of the countries under survey. The NRAs in those countries explained that they regulate or plan to regulate in the nearby future[91] access to physical infrastructure of the SMP operators, either in a standalone market or as an ancillary remedy to other markets. Therefore, BEREC is of the view that PIA regulation through asymmetric means is relevant today and will remain relevant in the future in most member states.

Another related aspect which is noteworthy from BEREC's findings is that PIA regulation was not always fully matched by a corresponding take-up of the services, but the reasons for that may be multifaceted, ranging from the inadequacy of the SMP operators' ducts for use (low quality) to the alternative operators' strategies of building own PI. In any event, BEREC can see positive developments in that regard when compared to the information previously available in that NRAs' methods to cope with irregularities concerning PIA became more

[89] https://digital-strategy.ec.europa.eu/en/library/study-future-electronic-communications-product-and-service-markets-subject-ex-ante-regulation

[90] BEREC does not mean to provide an exhaustive list of the status quo regarding a potential definition of a PIA standalone market but rather to give some examples supporting the point made.

[91] The market reviews were already published at the time of the survey.

sophisticated and complex, detailing the most prevalent issues at national level and assuring means to resolve them timely and efficiently (such as in the case of ARCEP, ANACOM, CNMC etc.)

Turning to how the NRAs see the interaction between the regulatory means available, essentially focusing on symmetric (mostly applied under BCRD/GIA or similar national laws) and asymmetric regulation, many NRAs see them as complementary tools, dependent on the type and magnitude of the competitive problems identified. In cases where those have a great magnitude, impact several services, establishment of a pricing obligation is seen as of utmost importance, the framework better fit to address those is the SMP regime. By contrast, where the potential competitive issues are limited in impact, intensity or time, symmetric regulation may prove enough, as highlighted by some countries. BEREC also asked for the NRAs' perspectives on the adequacy of GIA to address the competition problems identified in the context of market reviews. The answers are mixed in nature, which is natural in the light of the fact that, on the one hand, the BCRD provisions have been strengthened by the GIA especially to the aim of providing adequate competitive safeguards and, on the other hand, it may be too early to do a fully-pledged assessment of all the issues involved considering that the PIA developments are recent. All in all, what BEREC can say is that, according to the data provided, the majority of NRAs are of the view that sole reliance on symmetric regulation is not likely to be considered sufficient to meet the future challenges in fostering competition and network investment. Indeed, one specific area where this aspect becomes apparent is pricing, as SMP regulation allows for setting cost-oriented prices and the imposition of price-related obligations in a more effective and efficient way than through symmetric means (i.e. fair and reasonable). In any event, having noted the heterogeneity of prices and pricing practices as regards PIA, BEREC considers this as a topic where further harmonization can be envisaged.

Finally, considering the most important challenges noted going ahead, besides the aforementioned aspects, data availability, especially about non-telcos infrastructure has been highlighted, as well as need for processes harmonization. The changing scenery in the telco sector will require enhanced agility from regulators in using an appropriate mix of regulatory tools available to achieve the best outcomes possible in terms of fibre rollout, take-up, as well as satisfaction and affordability for end-users. Another topic touched upon, the in-house wiring, did not seem to be a widespread problem for now, but access to these cables and wires inside buildings might play a growing role in future.

Annex I: NRAs responding to the questionnaire

Table AI.1 – List of NRAs responding to the questionnaire

Current number	Country	Code	NRA
1	Albania	AL	AKEP
2	Austria	AT	RTR
3	Belgium	BE	BIPT
4	Bulgaria	BG	CRC
5	Croatia	HR	HAKOM
6	Cyprus	CY	OCECPR
7	Czechia	CZ	CTU
8	Denmark	DK	DBA
9	Estonia	EE	ECPTRA
10	Finland	FI	TRAFICOM
11	France	FR	Arcep
12	Germany	DE	BNetzA
13	Greece	GR	EETT
14	Hungary	HU	NMHH
15	Ireland	IE	ComReg
16	Italy	IT	AGCOM
17	Latvia	LV	SPRK
18	Liechtenstein	LI	AK
19	Lithuania	LT	RRT
20	Malta	MT	MCA
21	The Netherlands	NL	ACM
22	Norway	NO	NKom
23	Poland	PL	UKE
24	Portugal	PT	ANACOM
25	Romania	RO	ANCOM
26	Slovakia	SK	RU
27	Slovenia	SI	AKOS
28	Spain	ES	CNMC
29	Sweden	SE	PTS

Annex II. Excerpt of certain relevant questions and their answers

This annex consists of certain relevant questions that BEREC felt the need to highlight, including their answers. The answers are presented either in the form of tables or of charts, as deemed more appropriate by BEREC to support the findings included in the main body of the report.

Question AII.1: *Briefly describe the availability/reusability of the (a) telco operators' physical infrastructures and (b) non telco operators' physical infrastructures for the deployment of both fixed and mobile Very High-Capacity Networks (VHCNs).*
Also, if available/reusable, briefly describe the actual take-up/use of the available (i) telco operators' and (ii) non-telco operators' physical infrastructures for the deployment of VHCNs by ticking the scenario (only one) that fits best your situation.

Table AII.1. The predominant alternative for physical infrastructure

Most important type of PI	NRA assessment
Own physical infrastructure	
Scenario a	DBA, CTU, PTS, ComReg, ANCOM, NKom and ACM
Scenarios b, c, d and e	TRAFICOM, SPRK, NMHH, RRT, AKEP, BIPT, ECPTRA, AGCOM and AKOS
Access to other telco infrastructures	
Scenario f	AK, ARCEP and CRC
Scenarios b, c, d and e	OCECPR, CNMC, BNetzA, ANACOM, HAKOM, RU and UKE

Question AII.2: *To the extent possible, in case you have chosen (b), (c), (d) or (e) (i.e. intermediate scenarios), please indicate the alternative that is predominant:*
(i) own physical infrastructure
(ii) access to other telco infrastructures (in particular, incumbent operator's)
(iii) access to non-telco infrastructure

Table AII.2. Telco operators' physical infrastructures

Reference to the relevant PI	NRA assessment
Predominantly the incumbent operator´s physical infrastructure	AK, TRAFICOM, OCECPR, SPRK, NKom, NMHH, CNMC, BNetzA, CRC, ANACOM, HAKOM, RRT, AKEP, AGCOM, ECPTRA, AKOS, ARCEP and UKE
Both the incumbent and alternative telco operators' physical infrastructures	RU

Question AII.3: *Please indicate the main economic sector(s) where the owner(s) of the non-telco infrastructure(s) is (are) active in.*

Table AII.3. Non-telco operators' physical infrastructures

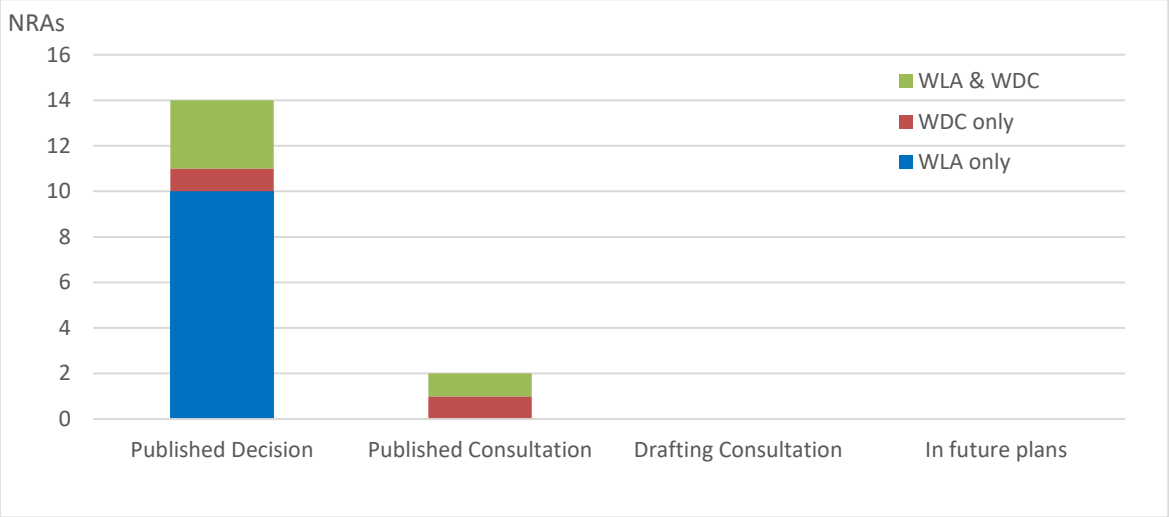
Reference to the relevant non-telco's PI	NRA assessment
Production, transport or distribution of electricity	OCECPR, NMHH, HAKOM, BIPT, TRAFICOM, ANACOM, RU, ECPTRA, BNetzA, CNMC, UKE and AGCOM
Transportation services	TRAFICOM, ANACOM, RU, ECPTRA and BNetzA
Public sector bodies	TRAFICOM, CNMC and AGCOM
Production, transport or distribution of water	TRAFICOM

Question AII.4: *Has your NRA completed or is currently conducting a review of the market for WLA, WCA or WDC which includes PIA as part of that remedies, while not part of the relevant market?*

Table AII.4: PIA as part of remedies in relevant markets

PIA Remedies	NRAs
WLA market only	AGCOM, AKOS, ARCEP, ANACOM, EETT, HAKOM, NKom, NMHH, RU and UKE
WDC market only	BIPT
WLA and WDC markets	AKEP, BNetzA, CNMC, RRT and OCECPR

Figure II.4: Status of PIA assessments as part of the remedies[92]



***Question AII.5**: Quite generally, which type of physical infrastructure is analysed by your NRA in the market analysis, at the market definition stage?*

Table AII.5: Physical infrastructure included in the market definition stage

Infrastructure types	NRAs
Ducts and pipes	AKEP, ANACOM, ARCEP, BIPT, ComReg, ECPTRA, MCA, SPRK and UKE
Chambers and manholes	ANACOM, ARCEP, ComReg, ECPTRA, SPRK and UKE
Poles and masts	AKEP, ANACOM, ARCEP, ComReg, ECPTRA, MCA, SPRK and UKE
Others[93]	ARCEP, AKEP and SPRK

***Question AII.6**: What ECN infrastructure is included in the focal product for PIA?*

Table AII.6: PIA focal products

Infrastructure types	NRAs
Ducts and pipes	AKEP, ANACOM, ARCEP, ComReg, ECPTRA and SPRK
Chambers and manholes	ANACOM, ARCEP, ComReg, ECPTRA and SPRK
Poles and masts	ANACOM, ARCEP, ComReg and ECPTRA
Others[94]	AKEP

***Question AII.7**: In completion of the question above, what non-telecom substitutes did you include in the definition of product market for PIA?*

Table AII.7: PIA product market definition

Infrastructure types	NRAs
Telecom ducts, poles & chambers	ComReg, ECPTRA and SPRK
Telecom ducts & dark fibre	AKEP
Telecom & electricity ducts, poles & chambers	ARCEP
Telecom ducts, poles & chambers; electricity poles; motorway ducts and chambers	ANACOM

[92] **WLA only decisions:** AGCOM, AKOS, ARCEP, ANACOM, EETT, HAKOM, NKom, NMHH, RU and UKE; **WDC only decisions:** BIPT; **WLA and WDC decisions:** AKEP, BNetzA, CNMC, RRT and OCECPR; **WDC only consultations:** BNetzA; **WLA and WDC consultations:** AKEP

[93] Sewers, access to buildings and dark fibre.

[94] Dark fibre.

***Question AII.8**: Please include the number of operators considered in each of the relevant PIA markets. Provide a separate response for each of the separately defined markets for PIA. How many competitors, with a market share above 5%, are included in the relevant market for PIA?*

Table AII.8: Competitors in the PIA market with > 5% market share

Relevant competitors	NRAs
1 Telecom infrastructure owner	SPRK
2 Telecom infrastructure owners	AKEP and ComReg
1 Telecom and 1 non-telecom infrastructure owners	ANACOM and ARCEP

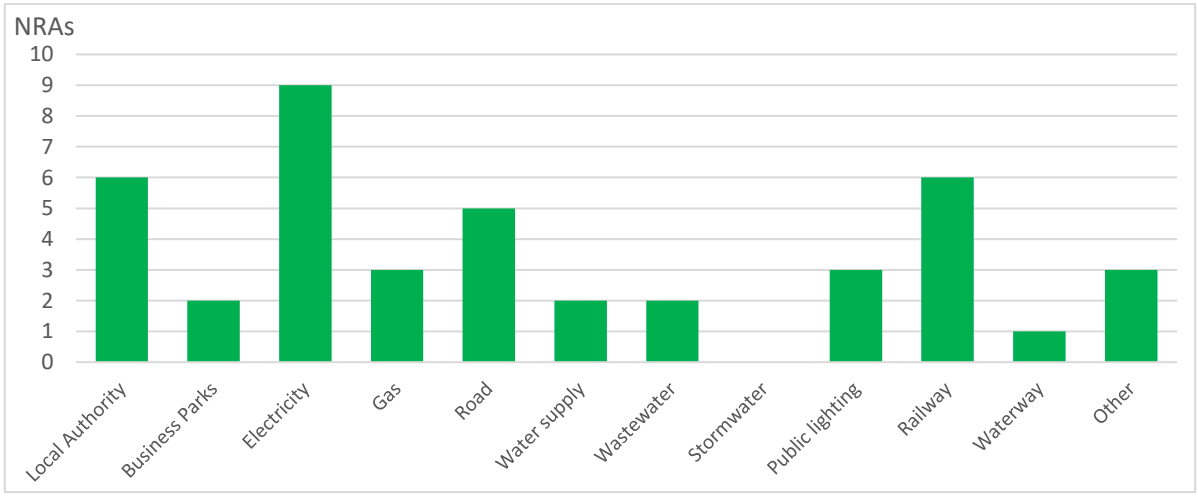
***Question AII.9**: Does your NRA collect data on:*
(i) non-telecom owners (who do not deploy ECNs) of telecom physical infrastructure (such as local authorities)?
(ii) non-telecom physical infrastructure (physical infrastructure whose primary use is not the deployment of ECNs) utilised to deploy ECNs?

Table AII.9: Data collection on non-telecom physical infrastructure

Non-telecom physical infrastructure	NRAs
Non-telcos owners of telecom PI	HAKOM and AK
Non-telco owners of on non-telecom PI	ACM, AKEP, ANACOM, CNMC, ECPTRA and RU
Non-telecom owners in general, irrespective of the type of PI	AGCOM, BNetzA, ComReg, MCA, OCECPR, RTR and UKE

***Question AII.10**: Does your NRA collect data on:*
(i) Telecom PIA of Local Authorities?
(ii) Telecom PIA of Industrial / Commercial Business Parks?
(iii) Electricity infrastructure?
(iv) Gas infrastructure?
(v) Road infrastructure?
(vi) Water supply infrastructure?
(vii) Wastewater (sewers) infrastructure?
(viii) Stormwater infrastructure?
(ix) Public lighting infrastructure?
(x) Railway infrastructure?
(xi) Waterway (canals) infrastructure?
(xii) Other infrastructure? (Please explain other infrastructure in the text box below the table)

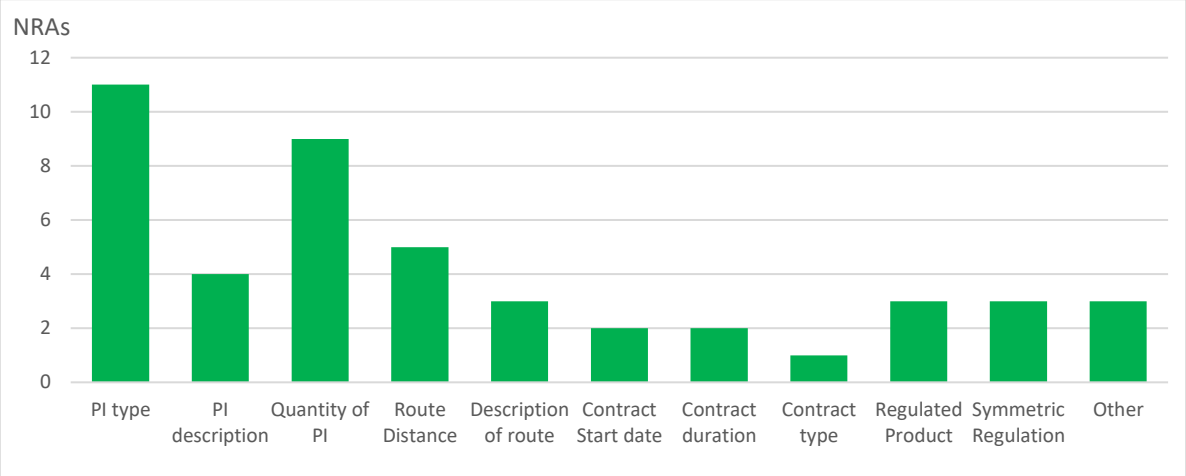
Figure AII.10: NRA data collection on non-telecom PI, by infrastructure type[95]



[95] **Local Authority:** AKEP, ANACOM, BNetzA, ComReg, HAKOM and MCA; **Business Parks:** ComReg, ECPTRA and HAKOM; **Electricity:** AKEP, ANACOM, BNetzA, CNMC, ComReg, ECPTRA, MCA, OCECPR and RU; **Gas:**

***Question AII.11**: What type of information do you collect from owners and consumers of physical infrastructure (PI) identified in before?*
(i) PI type (poles, duct/ pipes or subduct)
(ii) PI description (width of duct or subduct)
(iii) Quantity of PI sold or purchased (Nr of poles or km of ducts/pipes)
(iv) Route distance (for poles)
(v) Description of PI route/ area (a start to an end point or an area of deployment)
(vi) Contract Start date
(vii) Contract duration
(viii) Contract type (Rental / IRU (Indefeasible Right of Use) / Other)
(ix) Regulated Product
(x) Use of symmetric regulation (BCRD etc)
(xi) Other. Please specify

Figure AII.11: Type of data collected by NRAs on non-telecom PI[96]



***Question AII.12**: To which of these physical infrastructure elements SMP obligations have been imposed?*
(i) ducts, pipes
(ii) poles
(iii) chambers, manholes
(iv) dark fibre (as a subsidiary obligation, in the case access to a specific physical infrastructure asset is not available, e.g. for lack of space)
(v) other.

Table AII.12: Physical infrastructure (and additional elements) under SMP regulation

PI elements	NRAs
Ducts, pipes	AK, OCECPR, EETT, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg, RRT, RU, BIPT, AGCOM, ECPTRA, AKOS, Arcep and UKE
Poles	OCECPR, EETT, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, ComReg, AGCOM, ECPTRA, AKOS, Arcep and UKE
Chambers, manholes	AK, OCECPR, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg, RRT, RU, AGCOM, ECPTRA, AKOS, Arcep and UKE

BNetzA and CNMC; **Road:** AKEP, ANACOM, BNetzA, ComReg and MCA; **Water supply:** MCA and OCECPR; **Wastewater:** BNetzA and OCECPR; **Public lighting:** BNetzA, MCA and OCECPR; **Railway:** BNetzA, CNMC, ComReg, ECPTRA, RU and UKE; **Waterway:** UKE; **Other:** ANACOM, AK and UKE.

[96] **PI type:** AKEP, ANACOM, BNetzA, CNMC, ComReg, ECPTRA, HAKOM, MCA, OCECPR and RU; **PI description:** BNetzA, ComReg, HAKOM and OCECPR; **Quantity of PI:** ANACOM, BNetzA, CNMC, ComReg, ECPTRA, HAKOM, MCA, AK and RU; **Route Distance:** ANACOM, BNetzA, CNMC, ComReg and ECPTRA; **Description of route:** ComReg and UKE; **Contract Start date:** ComReg and HAKOM; **Contract duration:** ComReg and HAKOM; **Contract type:** ComReg; **Regulated Product:** ANACOM, ComReg and HAKOM; **Symmetric Regulation:** ANACOM, ComReg and HAKOM; **Other:** BNetzA, AK and UKE

Dark fibre (as subsidiary)	AK, OCECPR, EETT, CNMC, ANACOM, ComReg, RRT, BIPT, ECPTRA, Arcep, UKE and HAKOM

***Question AII.13**: What is the scope of the physical infrastructure remedies regarding the part of the network they apply to?*

Table AII.13: Relevant network segments that PI regulation refers to

Network segments	NRAs
In-building infrastructure	OCECPR, NKom, AKOS[97], Arcep[98] and UKE
Local access segment (without in-building infrastructure)	AK, OCECPR, EETT, SPRK, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg, RU, AKEP, BIPT, AGCOM, ECPTRA, AKOS, Arcep and UKE
Backhaul segment	AK, OCECPR, SPRK, NKom, NMHH, CNMC, BNetzA, ANACOM, HAKOM, ComReg, AKEP, BIPT, AGCOM, ECPTRA, Arcep and UKE
The entire physical network (e.g. including backbone)	OCECPR, SPRK, BNetzA, ANACOM, HAKOM, ComReg, RRT, AKEP, ECPTRA and Arcep

***Question AII.14**: Please indicate the type of network elements that are covered by regulation (ducts/pipes, poles, chambers/manholes, dark fibre, other)?*

Table AII.14: PI under regulation

Relevant PI	NRAs
Ducts, pipes; Poles; Chambers, manholes; Other	OCECPR, NKom, CNMC, ComReg and AGCOM
Ducts, pipes; Poles; Chambers, manholes	SPRK, NMHH, BNetzA, ANACOM, ECPTRA, AKOS and ARCEP
Ducts, pipes; Chambers, manholes; Other	AK
Ducts, pipes; Poles; Other	EETT
Ducts, pipes; Chambers, manholes	HAKOM and RRT
Ducts, pipes	RU and BIPT
Poles; Chambers, manholes; Other	UKE

***Question AII.15**: Please indicate, what kind of access services provided by the SMP operator remedies apply to ducts and pipes:*
(i) Feasibility analysis
(ii) Cable installation
(iii) Any restrictions regarding the cables which can be used (For example, is there a certification process or are there restrictions related e.g. to electricity, technology?)
(iv) Cable removal
(v) Interventions in ducts (e.g. cable replacement, joints)
(vi) Unblocking/repairing physical infrastructure
(vii) Other wholesale services
(viii) SMP operator is allowed to require certification from ANOs (for personnel)

Table AII.15: Details related to access services' provision

Mandated services related to ducts and pipes' access	NRAs
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts (e.g. cable replacement, joints) + Unblocking/repairing PI	AK
Feasibility analysis + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/ repairing PI	EETT and RRT
Feasibility analysis + Cable installation + Cable removal + Unblocking/repairing PI	NMHH
Feasibility analysis + Cable removal + Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	CNMC
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Unblocking/repairing PI	BNetzA
Cable removal + Interventions in ducts + Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	ComReg

[97] In NO and SI, access obligations apply to the extent the building is owned by the SMP operator.
[98] In FR, in practice, most in-building infrastructures are owned by the owner of the building, so the obligation does not necessarily apply. There is, however, an obligation from the symmetric regulation on fibre rollouts inside buildings (it concerns wiring).

Other wholesale services	AKEP
Feasibility analysis + Unblocking/repairing PI	AGCOM
Feasibility analysis	AKOS
Feasibility analysis + Interventions in ducts + Unblocking/repairing PI + Other wholesale services	ARCEP
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/ repairing PI + SMP operator is allowed to require certification from ANOs	OCECPR
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/ repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	SPRK
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/ repairing PI + SMP operator is allowed to require certification from ANOs	ANACOM
Feasibility analysis + Cable installation + Cable removal + Interventions in ducts + Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	HAKOM and ECPTRA

***Question AII.16**: Please indicate, what kind of transparency remedies apply to ducts and pipes:*
(i) Reference Offer
(ii) Database or (online) tool providing information on the physical infrastructure (such as maps, occupation information, etc.)
(iii) Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)

Table AII.16: Transparency measures concerning ducts and pipes

Transparency	NRAs
Reference Offer + Database or (online) tool providing information on the PI (such as maps, occupation information, etc.) + Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)	CNMC, BNetzA, ANACOM, HAKOM, RRT, AGCOM and ARCEP
Reference Offer + Database or (online) tool providing information on the physical infrastructure (such as maps, occupation information, etc.)	AK, OCECPR, EETT, SPRK, ComReg, RU and ECPTRA
Reference Offer + Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)	AKOS
Database or (online) tool providing information on the physical infrastructure (such as maps, occupation information, etc.) + Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)	UKE
Reference Offer	NKom, NMHH and BIPT

***Question AII.17**: Please indicate, what kind of non-discrimination remedies apply to ducts and pipes:*
(i) KPIs
(ii) SLAs
(iii) SLGs

Table AII.17: Non-discrimination related metrics

Indicators to assure non-discrimination	NRAs
KPIs + SLAs + SLGs	OCECPR, SPRK, NMHH, CNMC, BNetzA, ANACOM, ComReg, AGCOM, ECPTRA, AKOS, ARCEP and UKE
KPIs + SLAs	EETT and HAKOM
KPIs	RRT

***Question AII.18**: Please indicate, what kind of equivalence of access remedies apply to ducts and pipes:*
(i) Equivalence of Inputs (EoI)
(ii) Equivalence of Outputs (EoO)
(iii) Other

Table AII.18: Equivalence of access choices for ducts and pipes

Equivalence assurance	Number of NRAs
Equivalence of Inputs (EoI)	AK, OCECPR, ANACOM, ComReg, RU, AGCOM, AKOS

	and ARCEP
Equivalence of Outputs (EoO)	EETT, NKom, NMHH, CNMC, BNetzA, HAKOM, BIPT and UKE
Other	SPRK and ECPTRA

***Question AII.19**: Please indicate, what kind of price control remedies apply to ducts and pipes:*
(i) Cost orientation
(ii) Retail-Minus / Margin Squeeze Test / Economic Replicability Test
(iii) Benchmarking
(iv) Other price control remedy

Table AII.19: Price control remedies applicable to ducts and pipes

Price control remedies	NRAs
Cost orientation	AK, OCECPR, EETT, NKom, NMHH, CNMC, ANACOM, HAKOM, ComReg, RRT, RU, AGCOM, ECPTRA, AKOS and ARCEP
Cost orientation + Retail-minus / Margin squeeze test / Economic Replicability Test	SPRK
Cost orientation + Retail-minus / Margin squeeze test / Economic Replicability Test + Other price control remedy	BNetzA
Other price control remedy	BIPT

***Question AII.20**: Please indicate, if accounting separation remedy is applied to ducts and pipes:*
(i) Yes
(ii) No

Table AII.20: Accounting separation remedy

Accounting separation	NRAs
Yes	AK, SPRK, NMHH, CNMC, ANACOM, HAKOM, ComReg, RRT, RU, BIPT, AGCOM, ECPTRA and ARCEP
No	OCECPR, EETT, NKom, BNetzA, AKEP and AKOS

***Question AII.21**: Please indicate, what kind of access services provided by the SMP operator remedies apply to poles:*
(i) Feasibility analysis
(ii) Cable installation
(iii) Any restrictions regarding the cables which can be used (For example, is there a certification process or are there restrictions related e.g. to electricity, technology?)
(iv) Cable removal
(v) Interventions on poles (e.g. cable replacement, joints)
(vi) Unblocking/repairing physical infrastructure
(vii) Other wholesale services
(viii) SMP operator is allowed to require certification from ANOs (for personnel)

Table AII.21: Details related to access services' provision

Mandated services related to poles' access	NRAs
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions on poles + Unblocking/repairing PI	OCECPR
Feasibility analysis + Any restrictions regarding the cables which can be used	EETT
Feasibility analysis + Cable installation + Cable removal + Unblocking/ repairing PI	NMHH
Feasibility analysis + Cable removal + Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	CNMC,
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal	BNetzA
Cable removal+ Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	ComReg
Other wholesale services	AKEP, UKE
Feasibility analysis + Unblocking/repairing PI	AGCOM
Feasibility analysis + Cable installation + Cable removal + Interventions on poles +	ECPTRA

Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	
Feasibility analysis	AKOS
Feasibility analysis + Interventions on poles + Unblocking/repairing PI + Other wholesale services	ARCEP
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal+ Interventions on poles + Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	SPRK
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions on poles + Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	ANACOM

***Question AII.22**: Please indicate, what kind of transparency remedies apply to poles:*
(i) Reference Offer
(ii) Database or (online) tool providing information on the physical infrastructure (such as maps, occupation information, etc.)
(iii) Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)

Table AII.22: Transparency measures concerning poles

Transparency measures	NRAs
Reference Offer + Database or tool providing information on the PI + Automatic System for sending wholesale services requests and answers	CNMC, BNetzA, ANACOM, AGCOM, AKOS, ARCEP and UKE
Reference Offer + Database or tool providing information on the PI	OCECPR, EETT, SPRK, ComReg and ECPTRA
Reference Offer	NKom and NMHH

***Question AII.23**: Please indicate, what kind of non-discrimination remedies apply to poles:*
(i) KPIs
(ii) SLAs
(iii) SLGs

Table AII.23: Non-discrimination related metrics

Indicators to assure non-discrimination	NRAs
KPIs + SLAs + SLGs	SPRK, NMHH, CNMC, BNetzA, ANACOM, ComReg, AGCOM, ECPTRA, AKOS, ARCEP and UKE
KPIs + SLAs	EETT

***Question AII.24**: Please indicate, what kind of equivalence of access remedies apply to poles:*
(i) Equivalence of Inputs (EoI)
(ii) Equivalence of Outputs (EoO)
(iii) Other

Table AII.24: Equivalence of access choices for poles

Equivalence assurance	NRAs
Equivalence of Inputs (EoI)	OCECPR, ANACOM, ComReg, AGCOM, AKOS and ARCEP
Equivalence of Outputs (EoO)	EETT, NKom, NMHH, CNMC, BNetzA and UKE
Other	SPRK

***Question AII.25**: Please indicate, what kind of price control remedies apply to poles:*
(i) Cost orientation
(ii) Retail-Minus / Margin Squeeze Test / Economic Replicability Test
(iii) Benchmarking
(iv) Other price control remedy

Table AII.25: Price control remedies applicable to poles

Price control remedies	NRAs
Cost orientation	OCECPR, EETT, NKom, NMHH, CNMC, ANACOM, ComReg, AGCOM, ECPTRA, AKOS and ARCEP
Cost orientation + Retail-Minus/Margin Squeeze Test/ Economic Replicability Test	SPRK and BNetzA

***Question AII.26**: Please indicate, if accounting separation remedy is applied to poles:*
(i) Yes
(ii) No

Table AII.26: Accounting separation remedy

Accounting separation	NRAs
Yes	SPRK, NMHH, CNMC, ANACOM, ComReg, AGCOM, ECPTRA, ARCEP and UKE
No	OCECPR, EETT, NKom, BNetzA, AKEP and AKOS

***Question AII.27**: Please indicate, what kind of access services provided by the SMP operator remedies apply to chambers, manholes:*
(i) Feasibility analysis
(ii) Cable installation
(iii) Any restrictions regarding the cables which can be used (For example, is there a certification process or are there restrictions related e.g. to electricity, technology?)
(iv) Cable removal
(v) Interventions in ducts (e.g. cable replacement, joints)
(vi) Unblocking/repairing physical infrastructure
(vii) Other wholesale services
(viii) SMP operator is allowed to require certification from ANOs (for personnel)

Table AII.27: Details related to access services' provision

Mandated services related to chambers'/manholes' access	NRAs
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/repairing PI	OCECPR
Feasibility analysis + Cable installation + Cable removal + Unblocking/repairing PI	NMHH
Feasibility analysis + Cable removal + Interventions in ducts + Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	CNMC
Cable removal+ Interventions in ducts + Unblocking/ repairing PI	ComReg
Feasibility analysis + Unblocking/repairing PI	AGCOM
Feasibility analysis	AKOS
Feasibility analysis + Interventions in ducts + Unblocking/repairing PI + Other wholesale services	ARCEP
Other wholesale services	UKE
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	SPRK
Feasibility analysis + Cable installation + Any restrictions regarding the cables which can be used + Cable removal + Interventions in ducts + Unblocking/repairing PI + SMP operator is allowed to require certification from ANOs	ANACOM
Feasibility analysis + Cable installation + Cable removal + Interventions in ducts + Unblocking/repairing PI + Other wholesale services + SMP operator is allowed to require certification from ANOs	HAKOM and ECPTRA

***Question AII.28**: Please indicate, what kind of transparency remedies apply to chambers, manholes:*
(i) Reference Offer
(ii) Database or (online) tool providing information on the physical infrastructure (such as maps, occupation information, etc.)
(iii) Automatic System for sending wholesale services requests and answers (e.g. Web-Interface)

Table AII.28: Transparency measures concerning chambers, manholes

Transparency measures	NRAs
Reference offer + Database or tool providing information on the PI + Automatic System for sending wholesale services requests and answers	CNMC, BNetzA, ANACOM, HAKOM, AGCOM, ARCEP and UKE
Reference offer + Database or tool providing information on the PI	OCECPR, SPRK, ComReg and ECPTRA
Reference offer	NKom and NMHH
Database or tool providing information on the PI	AKEP

Reference offer + Automatic system for sending wholesale services requests and answers	AKOS

***Question AII.29**: Please indicate, what kind of non-discrimination remedies apply to chambers, manholes:*
(i) KPIs
(ii) SLAs
(iii) SLGs

Table AII.29: Non-discrimination related metrics

Indicators to assure non-discrimination	NRAs
KPIs + SLAs + SLGs	SPRK, NMHH, CNMC, BNetzA, ANACOM, AGCOM, ECPTRA, AKOS, ARCEP and UKE
KPIs + SLAs	HAKOM
SLAs + SLGs	ComReg

***Question AII.30**: Please indicate, what kind of equivalence of access remedies apply to chambers, manholes:*
(i) Equivalence of Inputs (EoI)
(ii) Equivalence of Outputs (EoO)
(iii) Other

Table AII.30: Equivalence of access choices for chambers, manholes

Equivalence assurance	NRAs
Equivalence of Outputs (EoO)	NKom, NMHH, CNMC, BNetzA, HAKOM and UKE
Equivalence of Inputs (EoI)	OCECPR, ANACOM, ComReg, AGCOM and ARCEP
Other	SPRK

***Question AII.31**: Please indicate, what kind of price control remedies apply to chambers, manholes:*
(i) Cost orientation
(ii) Retail-Minus / Margin Squeeze Test / Economic Replicability Test
(iii) Benchmarking
(iv) Other price control remedy

Table AII.31: Price control remedies applicable to chambers, manholes

Price control remedies	NRAs
Cost orientation	OCECPR, NKom, NMHH, CNMC, ANACOM, HAKOM, ComReg, AGCOM, ECPTRA, AKOS and ARCEP
Cost orientation+ Retail-Minus / Margin Squeeze Test / Economic Replicability Test	SPRK

***Question AII.32**: Please indicate, if accounting separation remedy is applied to chambers, manholes:*
(i) Yes
(ii) No

Table AII.32: Accounting separation remedy

Accounting separation	NRAs
Yes	SPRK, NMHH, CNMC, ANACOM, HAKOM, ComReg, AGCOM, ECPTRA and ARCEP
No	OCECPR, NKom, BNetzA, AKEP and AKOS

***Question AII.33**: Is cost-oriented price regulation imposed for access to poles? If yes, please specify if the pricing structure for access to poles includes the following elements:*
(i) One-off charge
(ii) Monthly/yearly charge
(iii) Pluriannual IRU charge
(iv) Cancellation fee
(v) Additional fee

Table AII.33 - One-off, additional and recurring fees for access to poles[99]

NRAs	Reported one-off charges	Reported additional fees	Monthly/yearly fees
OCECPR	N.A.	N.A.	Prices are dynamic and calculated on an annual basis based on the quotient of the total cost of poles and number of operators using the poles.
SPRK	N.A.	Price for access to the GIS tool – 255.00 EUR/month. Price per technical evaluation service – 265 EUR per initial 6 poles; 32.50 EUR per every next pole. Price per practical technical research (PTR) - 525 EUR for initial 6 poles; 40.27 EUR per every next pole.	18.45 EUR/month per initial 6 poles; 1.00 EUR/month per every next pole
NMHH	N.A.	On-site feasibility survey: (i) up to 200 m: 87 EUR + 0,44 EUR additional m, (ii) cable installation: 0.49 EUR/m, (iii) supervision: 12.74 EUR /hour	0.21 EUR/pole/month
CNMC	(i) Technical validation: 59.70 EUR (30.85 EUR when only drop cables are included). (ii) Site survey: 175.13 EUR + 6.24 EUR x number of visited poles. (iii) Technical analysis of poles: 7.16 EUR x total number of poles + 14.31 EUR x number of poles that must be replaced to support the new operator's cable. (iv) Information systems updates: 35.82 EUR	N.A.	(i) Wooden pole: 0.45 EUR/pole/month (ii) Concrete pole: 1.39 EUR/pole/month (iii) Polyester pole: 0.78 EUR/pole/month
ANACOM	Feasibility =63.3 EUR + n poles x 14.9 EUR	N.A.	Cable pole attachment 1.00 EUR, per month
ComReg	The incumbent can charge the costs of processing the pole order, tree trimming costs and removal and replacement of pole furniture costs as one-off charges. These charges must be pre-notified by the incumbent to the NRA and to access seekers before they become effective.	N.A.	21.31 EUR, yearly The price per pole is shared equally by number of users on the pole.
AGCOM	Collocation on the pole of an optical distribution box: 588 EUR	Cartography update: 142.98 EUR	IRU 15 years (4.14 EUR/m), IRU 20 years (4.78 EUR/m), 2024.
AKOS	N.A.	N.A.	28.86 EUR/km
UKE	N.A.	N.A.	0.87 EUR/pole/month
BNetzA	Fee for offer pole: 261.55 EUR (initial pole) + 2.31 EUR (for every additional pole) Fee for project realization: 178.34 EUR base fee processing and realization + 498.58 EUR (initial pole) + 164.93 EUR (for every additional pole)	Documentation charge 32.37 EUR; Commissioning of security services 23.89 EUR; Security services during deployment at cost for effort	1.70 EUR /pole /month

***Question AII.34**: In relation to PIA, if cost-oriented price regulation is imposed, please specify the cost standard:*
(i) Fully Distributed Cost (FDC)
(ii) Long Run Incremental Cost (LRIC)

[99] Additionally, for Germany, the information can be found following the link: https://circabc.europa.eu/ui/group/2328c58f-1fed-4402-a6cc-0f0237699dc3/library/b0d7a2e2-7124-4c81-9463-99fa692a61e9/details

(iii) Long Run Incremental Cost+ (LRIC+)
(iv) Long Run Average Incremental Cost (LRAIC)
(v) Long Run Average Incremental Cost+ (LRAIC+)
(vi) Pure Long Run Incremental Cost (Pure LRIC)
(vii) Other

Table AII.34 – Cost standard used for establishing the cost-oriented prices for access to PIA

NRAs	Cost standard
AGCOM	LRAIC+
AK	FDC
AKOS	LRIC+
ANACOM	FDC
ARCEP	FDC
BIPT	LRAIC+
BNETZA	LRAIC+
CNMC	LRIC+
COMREG	LRAIC+ costs for the PIA assets that need to be replaced or renewed FDC for the PIA assets that are reusable for the rollout of NGA services
ECPTRA	FDC
EETT	LRIC+
HAKOM	LRIC+
NKOM	FDC
NMHH	LRIC+
OCEPR	FDC
RRT	FDC
RU	LRIC+
SPRK	FDC

Question AII.35: *Is this a separate database or (online) tool from the Single Information Point on physical infrastructure, in the sense of article 4 of the Broadband Cost Reduction Directive 2014/61/EU?*

Table AII.35 – Transparency application in the SMP regulation

Implementation of a database or (online) tool providing relevant information in SMP regulation	NRAs
The same as the Single Information Point (SIP) provided by the BCRD	AKEP, BNetzA, ECPTRA, RU and UKE
Separate system provided by the SMP operator	AGCOM, ANACOM[100], AKOS, ARCEP, CNMC, ComReg, HAKOM and SPRK
Mixed (both SIP and system provided by SMP operator)	AK and OCECPR
Other instance	RRT[101] and EETT[102]

Question AII.36: *If the database or (online) tool was set up by the SMP operator, how are the implementation costs accounted for?*

Table AII.36 – Account of the implementation costs for the transparency obligations

Account of the costs	NRA
Costs borne by the SMP operator	AKOS and AK
(Recurrent) contributions by other operators to access the database or (online) tool	ANACOM, ARCEP, HAKOM and OCECPR
Included in the access fees for physical infrastructure	AGCOM, CNMC, ComReg, ECPTRA and SPRK

[100] In the case of PT, a separate system provided by the SMP operator and the SIP are both in place. It should be noted that their functions are not complementary (but rather duplicate, where one system was based on the other system).
[101] National web-based geographic information system implemented by the Ministry of Environment that combines functionalities of transparency regarding existing physical infrastructure as well as planned civil works.
[102] Ministry of Digital Infrastructure

Question AII.37**: Please indicate, what sort of information (from three described options below - B, M and V) is shared via this database or (online) tool, and on the base of which regulation for **ducts and pipes/poles/chambers, manholes:
(i) "B" - the information is provided based on the implementation of the Broadband Cost Reduction Directive in your country
(ii) "M" - the information is provided based on a remedy imposed in a market analysis
(iii) "V" - the information is provided by the operator on a voluntary basis

Table AII.37a – Overview of the detailed information provided due to the transparency remedy imposed

Type of information or functionalities	Ducts and pipes	Poles	Manholes
Geographical maps with the location of the concerned civil infrastructure	AGCOM, AKEP, ANACOM, AK, Arcep, BNetzA, CNMC, ComReg, ECPTRA, EETT, HAKOM, NKom[103], OCECPR, RRT, RU and SPRK	AGCOM, AKEP, ANACOM, Arcep, BNetzA, CNMC, ComReg, HAKOM[104], NKom, OCECPR and UKE	AKEP, ANACOM, Arcep, BNetzA, CNMC, ComReg, EETT, HAKOM, OCECPR, RRT, SPRK and UKE
Occupation level of the concerned civil infrastructure	AKEP, AKOS, ANACOM, AK, Arcep, BNetzA, ComReg, EETT, HAKOM, OCECPR and RU	AKEP, AKOS, Arcep, ComReg, HAKOM, OCECPR and UKE	AKEP, Arcep, ComReg, ECPTRA, HAKOM, OCECPR, SPRK and UKE
Technical specifications (e.g. diameter of ducts)	AKEP, AKOS, ANACOM, ARK, Arcep, BNetzA, CNMC, ComReg, HAKOM, OCECPR and RRT	AKEP, ANACOM, Arcep, BNetzA, CNMC, ComReg, HAKOM, OCECPR and UKE	AKEP, Arcep, BNetzA, CNMC, ComReg, HAKOM, OCECPR, RRT and UKE
State of the infrastructure	AKEP, ANACOM, AR, Arcep, ComReg, NKom, OCECPR, RRT and SPRK	AKEP, ANACOM, Arcep, ComReg, NKom, OCECPR and UKE	AKEP, Arcep, ComReg, NKom, OCECPR, RRT, SPRK and UKE
Access modalities/Reference offer	AGCOM, AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC, ECPTRA, HAKOM, OCECPR, RRT, RU and SPRK	AGCOM, AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC, HAKOM, OCECPR and UKE	AKEP, AKOS, Arcep, BNetzA, CNMC, ECPTRA, HAKOM, OCECPR, RRT, SPRK and UKE
Real-time consultable information (as opposed to "information available on request")	AKEP, ANACOM, Arcep, CNMC, ComReg, EETT, HAKOM and NKom	ANACOM, Arcep, CNMC, ComReg, HAKOM, NKom and UKE	Arcep, CNMC, ComReg, EETT, HAKOM, NKom and UKE
Online possibility to request access	AGCOM, AKEP, AKOS, ANACOM, Arcep, CNMC, HAKOM and SPRK	AGCOM, AKOS, ANACOM, Arcep, CNMC, HAKOM, SPRK and UKE	AKOS, Arcep, CNMC, HAKOM, SPRK and UKE
Other	ComReg[105] and EETT[106]	ComReg	ComReg

Table AII.37b – Type of regulation that the details of the transparency measures are based on for ducts and pipes

Type of information or functionalities	Market regulation	BCRD	Both BCRD and market regulation	Both market regulation and voluntary
Geographical maps with the location of the concerned civil infrastructure	AGCOM, AK, Arcep, CNMC, ComReg, ECPTRA, RRT, RU and SPRK	AKEP, BNetzA,	ANACOM and OCECPR	HAKOM

[103] Nkom does not impose a database or (online) tool providing information on PI as part of the transparency remedy in its SMP regulation, but information is provided based on the functionalities of the SIP.
[104] In Croatia, access to poles is not regulated, as opposed to ducts and manholes, but transparency is offered by the SMP operator on a voluntary basis.
[105] Reservation information for ducts, subducts, poles and chambers including co-ordinate references or Object ID of the start and the end of the route, requested date of reservation and reservation lapse date, as well as photographs of PI.
[106] Information on home passed/home connected buildings, building identification numbers.

Type of information or functionalities	Market regulation	BCRD	Both BCRD and market regulation	Both market regulation and voluntary
		EETT and NKom		
Occupation level of the concerned civil infrastructure	AKOS, ANACOM, AK, Arcep, BNetzA, ComReg, OCECPR and RU	AKEP and EETT	N.A.	HAKOM
Technical specifications (e.g. diameter of ducts)	AKEP, AKOS, ANACOM, AK, Arcep, BNetzA, CNMC, ComReg and RRT	N.A.	OCECPR	HAKOM
State of the infrastructure	AK, Arcep, ComReg, RRT and SPRK	AKEP, ANACOM and NKom	OCECPR	N.A.
Access modalities/ Reference offer	AGCOM, AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC, ECPTRA, HAKOM, OCECPR, RRT, RU and SPRK	N.A.	N.A.	N.A.
Real-time consultable information (as opposed to "information available on request")	Arcep, CNMC and ComReg	AKEP, EETT and NKom	ANACOM)	HAKOM
Online possibility to request access	AGCOM, AKOS, ANACOM, Arcep, CNMC, SPRK	N.A.	N.A.	HAKOM
Other	ComReg	EETT	N.A.	N.A.

Only in Albania, there is voluntary provision of the online possibility to request access.

Table AII.37c – Type of regulation that the details of the transparency measures are based on for poles

Type of information or functionalities	Market regulation	BCRD	Voluntary basis	Both BCRD and market regulation
Geographical maps with the location of the concerned civil infrastructure	AGCOM, Arcep, CNMC, and ComReg	AKEP, BNetzA, NKom and UKE	HAKOM	ANACOM and OCECPR
Occupation level of the concerned civil infrastructure	AKOS, Arcep, ComReg and OCECPR	AKEP and UKE	HAKOM	N.A.
Technical specifications (e.g. diameter of ducts)	AKEP, Arcep, BNetzA, CNMC, ComReg and OCECPR	ANACOM and UKE	HAKOM	N.A.
State of the infrastructure	Arcep, ComReg and OCECPR	AKEP, ANACOM, NKom and UKE	N.A.	N.A.
Access modalities / Reference offer	AGCOM, AKEP, AKOS, ANACOM, Arcep, BNetzA, CNMC and OCECPR	UKE	HAKOM	N.A.
Real-time consultable information (as opposed to "information available on request")	Arcep, CNMC and ComReg	NKom and UKE	HAKOM	ANACOM
Online possibility to request access	AGCOM, AKOS, ANACOM, Arcep, CNMC and SPRK	UKE	HAKOM	N.A.
Other	ComReg	N.A.	N.A.	N.A.

Table AII.37d – Type of regulation that the details of the transparency measures are based on for chambers and manholes

Type of information or functionalities	Market regulation	BCRD	Both BCRD and market regulation	Both market regulation and voluntary
Geographical maps with the location of the concerned civil infrastructure	Arcep, CNMC, ComReg, RRT and SPRK	AKEP, BNetzA, EETT and UKE	ANACOM and OCECPR	HAKOM
Occupation level of the concerned civil infrastructure	Arcep, ComReg, ECPTRA, OCECPR and SPRK	AKEP and UKE	N.A.	HAKOM
Technical specifications (e.g. diameter of ducts)	AKEP, Arcep, BNetzA, CNMC, ComReg, OCECPR and RRT	UKE	N.A.	HAKOM
State of the infrastructure	Arcep, ComReg, OCECPR, RRT and SPRK	AKEP, NKom and UKE	N.A.	N.A.
Access modalities / Reference offer	AKEP, AKOS, Arcep, BNetzA, CNMC, ECPTRA, HAKOM, OCECPR, RRT, SPRK	UKE	N.A.	N.A.
Real-time consultable information (as opposed to "information available on request")	Arcep, CNMC and ComReg	EETT, NKom and UKE	N.A.	HAKOM
Online possibility to request access	AKOS, Arcep, CNMC and SPRK	UKE	N.A.	HAKOM
Other	ComReg	N.A.	N.A.	N.A.

***Question AII.38**: Does your NRA require a complete list of the concrete associated with the provision of PIA by the SMP operator in its reference offer (e.g. technical validation, survey, cable installation, cable removal)?*
If yes, does your NRA impose a level of quality (Service Level agreement -SLAs-/Service Level Objectives -SLOs-)?
If yes, are they set in the NRA's decision or in the SMP's reference offer?
Does your NRA require KPIs to monitor the quality of services?
(i) Yes
(ii) No

Table AII.38: Quality assurance for PIA

Means of quality assurance	NRAs
NRAs imposing a level of quality through SLAs or SLOs	ComReg, AK, SPRK, NMHH, CNMC, BNetzA, HAKOM, ANACOM, RU, ARCEP, UKE, AGCOM, OCECPR, AKOS and EETT
Imposed in the NRA's decision or in the reference offer	ComReg, AK[107], SPRK, NMHH, CNMC[108], BNetzA[109], HAKOM, ANACOM, RU, ARCEP, UKE, AGCOM[110], OCECPR[111], AKOS and EETT[112]
NRAs imposing KPIs to monitor the services' quality	ComReg, SPRK, NMHH, CNMC, BnetzA, HAKOM, ANACOM, ARCEP, UKE, OCECPR and ECPTRA[113]

[107] In the SMP's reference offer.
[108] Ibidem
[109] The SLAs will be part of the reference offer. Telekom submitted a first draft without such agreements, and it will be obliged to include them in its second draft.
[110] Set in the reference and approved by the NRA.
[111] In the SMP's reference offer.
[112] The PIA reference offer was not published at the time of the survey.
[113] ECPTRA does not require KPIs yet, but it will do so as per the current draft decision of the PIA market.

***Question AII.39**: Has your NRA imposed asymmetric/SMP remedies for PIA on one or more telecom operators, for the last 3 years or more?*

Table AII.39: Status of recent markets reviews with PIA remedies

Status of recent markets with PIA remedies	NRAs
Current review only	AKOS, BIPT, RRT, ECPTRA, HAKOM, NMHH, AK and UKE
Past reviews only	AGCOM, CNMC, OCECPR and RU
Current and past reviews	ANACOM, ARCEP, ComReg, NKom and SPRK

***Question AII.40:** What wholesale market were PIA remedies applied in?*

Table AII.40: Recent markets with PIA remedies

Markets with PIA remedies	NRAs
WLA	AGCOM, CNMC, RU and SPRK
PIA	ANACOM, ARCEP and ComReg
WLA and WDC	OCECPR

***Question AII.41:** What is the total number of VHCN operators, excluding the SMP operator, during the review period?*

Table AII.41: Number of other VHCN operators, which do not have regulation on PIA imposed

Number of other VHCN operators	NRAs
< 5 Operators	AGCOM and OCECPR
5 – 99 Operators	ANACOM, ARCEP, CNMC and ComReg
100+ Operators	NKom and SPRK

***Question AII.42:** Do you have more than one operator with SMP with PIA remedies?*

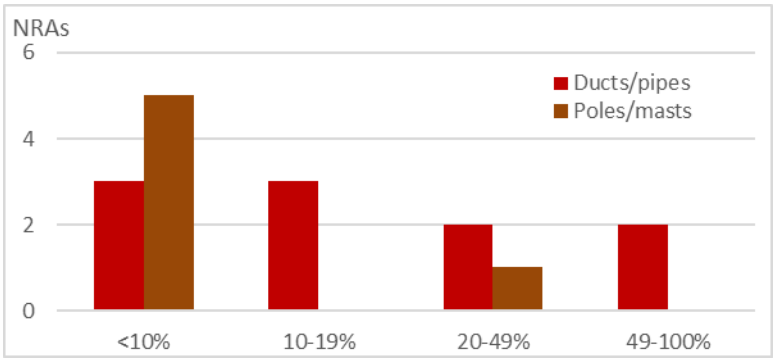
Table AII.42: Number of SMP operators with PIA remedies

Number of SMP operators with PIA remedies	NRAs
1	ANACOM, AGCOM, AKOS, ARCEP, BIPT, CNMC, ComReg, RRT, ECPTRA, HAKOM, NKom, AK, OCECPR, RI, SPRK and UKE
2+	NMHH

***Question AII.43:** What share of the SMP operator's infrastructure was rented/leased during the review period?*

Figure AII.43: Share of the SMP operator's main physical infrastructure elements rented/leased[114]

[114] **Ducts/pipes:** "<10%" (BIPT, NMHH and SPRK), "10-19%" (AGCOM, ComReg and HAKOM), "20-49%" (RRT and an NRA), "49-100%" (AK and ANACOM); **Poles/Masts:** "<10%" (AGCOM, BIPT, HAKOM, NMHH and SPRK), "20-49%" (ComReg).



Question AII.44: *Have you imposed any symmetric regulation regarding access to physical infrastructures and/or wiring and cables?*

Table AII.44: Summary of NRAs' responses regarding symmetrical regulation

NRAs	Yes, have imposed under Article 61 of EECC	Yes, have imposed but under another regime	No, have not imposed	Considered/tried to impose, but decision was set aside (e.g. by the Court)	Have not imposed but are currently considering
RTR		X			
AK			X		
Traficom		X			
OCECPR	X				
EETT	X	X			
SPRK		X			
NKom					X
DBA			X		
NMHH			X		
CTU		X			
PTS		X			
CNMC		X			
BNetzA		X			
ANACOM		X			
HAKOM	X	X			
ComReg					X
MCA			X		
RRT			X		
ANCOM			X		
AKEP			X		
BIPT			X		
AGCOM	X				
ECPTRA		X			
AKOS	X				
ARCEP	X				

Question AII.45*: What has been, in your view, the market outcome as a result of imposing SMP remedies on access to physical infrastructure? In particular, to what extent has regulated access to the physical infrastructure of the SMP operator been used by alternative operators, in contraposition to other types of access such as access on the basis of the Broadband Cost Reduction Directive?*

Table AII.39: Symmetric vs asymmetric regulation

	NRAs
Access to physical infrastructure under the SMP regime has been relevant for the development of the markets	ANACOM, Arcep, CNMC, ECPTRA, NKom, RRT, RU, SPRK and AGCOM
Access to physical infrastructure has mainly taken place via the BCRD	OCECPR and UKE

***Question AII.46**: Do you foresee that in the future access to physical infrastructure on the basis of the Broadband Cost Reduction Directive/Gigabit Infrastructure Act may be sufficient to lift the obligations that are currently imposed via ex ante regulation? What would be the key elements that in your view could lead to the lifting of ex ante regulation?*

Table AII.46: Expected developments in PIA regulation

Forward-looking perspective	NRAs
GIA may be sufficient in the future	OCECPR, NKom, ANCOM, AKEP and UKE
Prospectively, SMP regulation of access to PI is still deemed necessary	ANACOM, Arcep, CNMC, ECPTRA, RRT, SPRK, AGCOM, BNetzA, HAKOM, BIPT and AKOS