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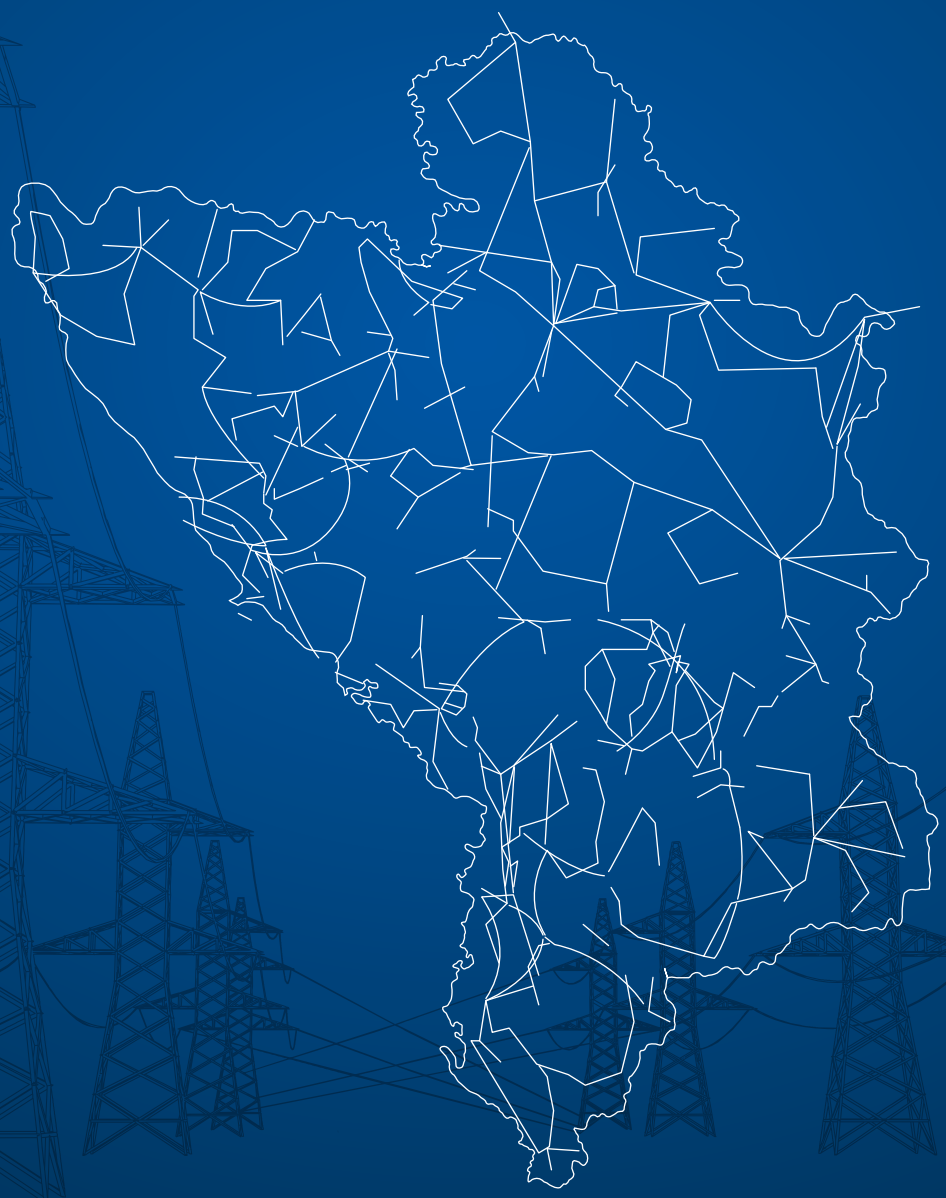
FOSTERING INFRASTRUCTURE SHARING IN THE WESTERN BALKANS:

Balkans Digital Highway Pre-feasibility Studies

SUMMARY



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Western Balkans
Balkans Digital Highway
Summary

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CONTENTS

EXECUTIVE SUMMARY

The availability of broadband infrastructure has been found to be an important determinant of a country's economic and social development. In recognition of this, the European Union (EU) adopted a Digital Agenda for Europe in 2012 that has since been updated by the European 2025 Gigabit Society. The deployment of broadband infrastructure has also come to be a major priority for the Western Balkans region, which consists of Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia. Infrastructure sharing, an agreement between two or more operators (including utilities from other sectors of the economy, such as electricity) to share various parts of their infrastructure to provide services, is an effective way to lower the costs of deploying broadband communications networks and obtain better connectivity; it also helps to protect the environment, reduce resource consumption, and increase energy efficiency.

Given the benefits, the World Bank set up the Balkans Digital Highway initiative to explore and advance infrastructure-sharing opportunities in the Western Balkans region. The initiative carried out a number of pre-feasibility studies to (i) explore opportunities to use the excess capacity on existing fiber optic ground wire networks located alongside power grids operated by transmission system operators (TSOs) in the six Western Balkan countries to generate additional income, (ii) make a technical assessment of the existing excess optical ground wire (OPGW) capacity on the TSOs' networks, (iii) determine what changes are required in the national telecommunications and energy frameworks within and between countries to operationalize infrastructure sharing, and (iv) develop an action plan to advance infrastructure sharing in the region that addresses the technical, organizational, and regulatory bottlenecks in each country.

The engagement of utilities (gas, transport, electricity) in infrastructure-sharing activities is often driven by external factors, such as government or regulatory pressure, and internal considerations, such as the need to optimize costs and diversify revenue. Utilities usually already have extensive infrastructure in place or privileged rights-of-way for building new structures. However, analysis revealed that in the Western Balkans, utilities, particularly the electricity sector, are facing declining returns as electricity consumption flattens, making infrastructure sharing an attractive way to diversify revenue. Similarly, the currently moderate or stagnating growth of mobile and fixed broadband penetration and the quality of services are limited by the region's existing telecommunications infrastructure. This encourages telecom operators to optimize their operating and capital expenditures by using the shared infrastructure and fiber optic network of the TSO.

If the region's TSOs were to use their fiber assets to increase the network supply, it would potentially transform the wholesale broadband markets in the Western Balkans. Indeed, estimates indicate that only 35 percent of the total capacity of all the TSOs' fiber optic networks in the region is currently being utilized. Infrastructure sharing can thus be seen as a "win-win" proposition: the government wins by saving public funds and avoiding the unnecessary duplication of infrastructure, utilities win by lowering the cost of installing infrastructure they will need anyway, and telecom operators win by optimizing their networks to focus on providing access to hard-to-reach areas and boosting retail operations.

A technical inventory of the current excess OPGW capacity on Western Balkan energy utility networks points to the clear potential for national-level and cross-border infrastructure sharing, and those existing networks might be a good starting point for further development. Currently, however, engagement in infrastructure sharing in the region is low because of the absence of strategic political support and the lack of awareness of the importance of TSOs' OPGW networks to the development of the electronic communications market.

The review of the policy and regulatory frameworks revealed that all six countries have transposed the relevant EU directives into their energy laws to enable TSOs to engage in infrastructure sharing, and wholesale broadband services (defined as "dark fiber" in the pre-feasibility studies) are not regulated ex ante anywhere in the region. Some countries have legislation to manage dispute resolution in infrastructure sharing and others do not, and in all but Kosovo, electronic communications services are not subject to official procurement procedures, offering potential players more market flexibility. Finally, no limitations on public-private partnerships were found in the legislation of any of the countries, which is useful when a combination of public and private funds is needed. These relatively few legislative obstacles could easily be eliminated to create more uniform conditions for the development of infrastructure-sharing services across the region.

Recommendations:

- **Clear and long-term national broadband development strategic goals are a necessity.** The absence of strategic guidance creates uncertainties for prospective market players. Given its potential economic impact, broadband policy should be at the top of each government's agenda.
- **Regulatory and legislative alignment with EU legislation should continue.** Legislative bottlenecks related to infrastructure sharing need to be removed to create regulatory certainty, ease the TSOs' entry into the market, and ensure transparent, equal, and non-discriminatory rules for all.
- **A review of TSOs' long-term strategic objectives is needed.** The approval of clear strategic objectives by company shareholders would ease communication with regulators, policy makers, and other stakeholders and thereby simplify a company's decision-making process.
- **Choosing a wholesale-only business model is advisable.** Forecasts show that this business model has great potential in the future, with business opportunities that could include physical infrastructure sharing, dark fiber leasing, colocation space leasing, and/or capacity leasing.
- **The separation of telecom activities from the TSO's primary functions is advisable.** A separate organizational unit ensures more flexibility and transparency and provides a stronger incentive for employees, who are usually remunerated according to their output.
- **Start locally – think globally.** It is easier to begin infrastructure-sharing activities at a national level, which is a necessary prerequisite in any case to international cooperation. TSOs in the Western Balkan TSOs should consider international cooperation—starting within the region.
- **Human capacity is key to success.** Even those TSOs that have already begun sharing their free optical infrastructure often do not have enough staff in their communications technology departments to support the infrastructure services marketing and sales tasks and the implementation procedures.

I. INTRODUCTION

1.1.

Strategic importance of infrastructure sharing

It is widely recognized that the availability of broadband connectivity is an important determinant of the economic and social development of a region or country. Access to this high-speed broadband network can help foster economic growth, facilitate social cohesion, and improve citizen well-being. It is therefore not surprising that the acceleration of broadband diffusion has become one of the key policy aims for many national and international policy bodies. The European Union (EU) is no exception. In fact, the EU has long recognized and underlined the importance of widely available and competitively priced broadband and adopted a Digital Agenda for Europe in 2012[1] that was updated in 2016 to mirror the strategic objectives of the European 2025 Gigabit Society.[2] According to the EU, "very high-capacity Internet connectivity is essential to unleash the next wave of competitiveness and innovation and to allow Europe's businesses and citizens to harvest the full benefits of the Digital Single Market."[3] To that end, it outlined three main strategic objectives for 2025:[4]

1. Gigabit connectivity for all of the main socioeconomic drivers
2. Uninterrupted 5G coverage for all urban areas and major terrestrial transport paths
3. Access to connectivity offering at least 100 mbps for all European households

The deployment of broadband infrastructure has also come to be a major priority for the region of the Western Balkans, which consists of six countries: Albania, Bosnia and Herzegovina (BiH), Kosovo, Montenegro, North Macedonia, and Serbia. Indeed, the objective has been explicitly endorsed by the six Western Balkan leaders, who signed a Statement of Support at the Western Balkans Summit in Sofia on May 17, 2018. The following June, the European Commission (EC) adopted a staff working document on measures to support the Digital Agenda for the Western Balkans.[5] The broadband objectives of the EU, in which all of the Western Balkan countries aspire to membership, are therefore now directly relevant to the Western Balkans.

Research indicates that an increase in broadband penetration is not necessarily homogeneously distributed. Significant differences exist not only among countries and between wealthier and poorer regions but also within countries, especially between their rural and urban areas. The EC is therefore emphasizing efforts to overcome this and other challenges, particularly the need to minimize infrastructure deployment costs. This is where infrastructure sharing, an integral part of the EC's initiative, plays a vital role. The Western Balkan countries share this view, as they have agreed to *"d. Establish regional dialogue on commercialization of spare fibre optic assets; identify and address legal and regulatory constraints and implement the agreed commercialization model"* as part of the Digital Integration actions agreed by the region's leaders in the Multi-Annual Action Plan on a Regional Economic Area signed in Trieste in July 2017.[6]

The Balkans Digital Highway initiative was set up by the World Bank to (i) explore existing business opportunities for regional integration involving the energy and telecommunications sectors through infrastructure sharing and (ii) develop a plan of action to operationalize infrastructure sharing in the region's state-owned electricity transmission utilities. The initiative was designed to provide analyses, guidance, and critical input to the participating governments and their electricity transmission operators with a view to reaching consensus on a strategy to promote infrastructure sharing within and between utility companies.

[1] EC, "A Digital Agenda for Europe" (Brussels: European Commission, 2010), https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF.
[2] EC, "State of the Union 2016: Commission Paves the Way for More and Better Internet Connectivity for all Citizens and Businesses" (Brussels, European Commission, 2016), http://europa.eu/rapid/press-release_IP-16-3008_en.htm.
[3] EC, "Connectivity for a Competitive Single Market: Towards a European Gigabit Society" (Brussels: European Commission, 2016), https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52016DC0587.
[4] For information on the EU's program, "Broadband Europe," see https://ec.europa.eu/digital-single-market/en/broadband-europe.
[6] Regional Cooperation Council, "Consolidated Multi-Annual Action Plan for a Regional Economic Area in the Western Balkans Six" (Sarajevo: Regional Cooperation Council, 2017), https://www.rcc.int/docs/383/multi-annual-action-plan-for-a-regional-economic-area-in-the-western-balkans-six.

1.2.

What is infrastructure sharing and what are the benefits?

Infrastructure sharing is commonly understood as an agreement between two or more market players to share various parts of their infrastructure for the provision of services. This has been identified as an effective way to lower the cost of network deployment and to achieve better connectivity. Infrastructure sharing can also play an essential role in protecting the environment, reducing resource consumption, increasing energy efficiency, and achieving sustainable growth.[7] Sharing can take place within a particular sector (e.g., between telecom network providers) or between different sectors (e.g., between telecoms and other utilities, such as electricity grids, gas, or transport networks). Depending on the type, infrastructure sharing is usually categorized as either passive or active. Passive refers to the sharing of non-electronic infrastructure, such as sites, towers, poles, ducts, equipment rooms, and so forth, as well as civil engineering components, while active infrastructure sharing means that electronic (i.e., active) elements of the core network are shared, such as switches, antennas, management systems, or spectrum.[8]

It should be noted that infrastructure sharing within the telecom sector has already been taking place throughout the world for a number of years. Indeed, the increase in the number of network sharing agreements has been especially notable since the 3G network's licensing and regulatory requirements for network coverage were established. The deployment of 5G technology could lead to a second big wave in the number of sharing agreements.

In general, the benefits of infrastructure sharing, whether telecom infrastructure only or across-sectors, can be summarized as follows (see also figure 1 below):

>> **Cost savings.** One of the most important benefits of infrastructure sharing is that it helps to significantly cut broadband network expansion costs. It is widely agreed that civil engineering works constitute the dominant part of overall network deployment costs, regardless of the technology used, with estimates as high as 80 percent for certain technologies.[9] Thus according to the EC,[10] with proper infrastructure-sharing policies in place (for example, improved access to suitable physical infrastructure, more cooperation in civil engineering works, streamlined permit procedures for rolling out broadband networks, and more buildings ready for high-speed broadband), is it possible for an operator (a lessee) to save between 20 and 30 percent of network deployment costs. Other studies also record potentially significant cost savings (see table 1).

Cost savings for infrastructure owners will largely depend on the existing/owned infrastructure. If the infrastructure is already in place, its owners (e.g., telecoms or utilities) could partly cover depreciation and/or maintenance costs by leasing spare infrastructure components. If the infrastructure is yet to be built, cooperation in civil engineering works may bring their initial investments down, and/or the installation of extra capacities to be leased could guarantee additional revenues in the future.

It is worth mentioning that cost savings do not necessarily mean smaller investments or bigger profits. In an environment with clear strategic objectives, it instead means better tailored investments, where some (i.e., infrastructure owners) can focus their resources on core networks and others (e.g., internet service providers [ISPs]) can concentrate on access technologies. When governments learn that a 20-percent increase in information and communications technology (ICT) investment can expand a country's GDP by 1 percent,[11] they may consider implementing policies to promote these investments.

7 APEC, "Survey Report on Infrastructure Sharing and Broadband Development in APEC Region," APEC Telecommunications and Information Working Group (Singapore: Asia-Pacific Economic Cooperation, 2011), https://www.apec.org/Publications/2011/09/Survey-Report-on-Infrastructure-Sharing-and-Broadband-Development-in-APEC-Region.

8 ITU, "ITU Infrastructure Development Portal" (Geneva: International Telecommunication Union), https://www.itu.int/en/ITU-D/Regulatory-Market/Pages/InfrastructurePortal.aspx.

9 EC, "Impact Assessment Accompanying the Document Proposal for a Regulation on Measures to Reduce the Cost of Deploying High-Speed Electronic Communications Networks" (Brussels: European Commission, 2013), https://ec.europa.eu/digital-single-market/news/impact-assessment-accompanying-document-proposal-regulation-european-parliament-and-council.

10 Ibid.

11 Annie Turner, "20% Increase in ICT Investment = 1% Growth in GDP," Inform, July 2015, https://inform.tmforum.org/features-and-analysis/2015/07/20-increase-in-ict-investment-1-growth-in-gdp.

Table 1 Potential Savings from Infrastructure Sharing

#	Study	Savings from Infrastructure Sharing (compared to not sharing), %
1.	Analysys Mason, "The Costs of Deploying Fibre-Based Next-Generation Broadband Infrastructure" (2008), www.broadbanduk.org/wp-content/uploads/2012/08/http___www-broadbanduk6.pdf	16–24% This study evaluated the potential cost savings from the reuse of infrastructure owned by utilities. Cost savings depend on the areas covered (urban vs. national) and technologies chosen (FTTC vs. FTTP).
2.	Analysys Mason (2012), "PIA versus self-Build Fibre in the Final Third: Digging into the Financials," (2012)	29–58% The study examined the cost savings that may be achieved by using passive infrastructure sharing in the UK. It concludes that savings depend on areas covered and additional works to be done: from 29% in relatively densely populated areas using a combination of infrastructure sharing and traditional trenching to 58% in sparsely populated areas using the cheaper slot-cutting trenching approach.
3.	OFCOM/CSMG, "Economics of Shared Infrastructure Access" (2010), http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/csmg.pdf	57–67% The study constructed a cost model comparing the costs of sharing infrastructure and establishing a new network (in both urban and suburban areas). It concluded that reuse of existing ducts where possible could result in up to 57% cost savings in urban and 67% in suburban areas.
4.	EC, "Impact Assessment" (2013) http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%207999%202013%20ADD%204	75% According to this report, the initial cost of network deployment in Western Europe using existing ducts ranges from €20–25 per meter compared to an average of €80–100 per meter for deployments that require digging (costs were estimated by the Engage Group, Enhancing Next Generation Access Growth in Europe).
5.	BEREC, "Report on Infrastructure Sharing" (2018) https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8164-berec-report-on-infrastructure-sharing	16–35% This document provides an analysis of mobile network infrastructure-sharing arrangements that are in place in various European markets. According to the report, costs savings depend on the type of sharing: --passive sharing cost savings are between 16 and 35% of capital expenditures (CAPEX) and 16–35% of operating expenditures (OPEX); --active sharing (excluding spectrum) cost savings are 33–35% of CAPEX and 25–33% of OPEX.

>> **Network expansion/better connectivity.** Considering the amount of money needed to develop an end-to-end fiber network, it is difficult to expect that any one investor could commit to covering a substantial part of any country without public support, be it direct (financial subsidy) or indirect (demand subsidy and regulatory certainty).[12] Sharing the existing infrastructure or the costs of building it new may significantly improve the business case for the less-covered rural areas, where demand for internet services is lower and the cost of broadband network deployment is higher. Infrastructure sharing may similarly help to improve international connectivity if an interconnection with alternative infrastructures (such as electricity, transport, and so on) exists.

>> **Additional revenues.** Infrastructure sharing also benefits the host infrastructure providers through additional rental revenues. Depending on the business model and services provided, it can become an important revenue diversification source. Sharing only physical infrastructure would guarantee relatively lower revenues (at lower risk and additional expenditure) when compared to active infrastructure sharing or engagement in the provision of end-user services. Analyses of the Western Balkan region show that the provision of just dark fiber service can provide an additional 3–5 percent on top of existing revenues for transmission system operators (TSOs). A similar amount of additional revenue can be attributed to capacity services; these, however, require Dense Wavelength Division Multiplexing (DWDM) equipment that only a few Western Balkan TSOs possess. The engagement in retail broadband provision activities may offer revenue diversification for utilities of up to 20 percent,[13] though at significantly higher investment and risk.

>> **Competition and time-to-market.** Infrastructure sharing reduces barriers to entry for new market players. Upstream markets are often controlled by incumbent operators, and entering this market requires substantial initial investments. Therefore, by providing the possibility of accessing or deploying more economically viable backbones, infrastructure sharing offers a more rapid and cost-effective way to enter the market. By renting the whole or part of a high-quality backbone network, operators may concentrate their saved resources on the deployment of the access (terminating) part of the network. As communication technologies become increasingly complex, larger investments are needed in order to bring the latest technologies to end users. Infrastructure sharing, whether active or passive, allows operators to upgrade their networks more quickly and at lower cost. Sharing is especially attractive in less profitable regions, since it minimizes the investment needs there.[14]

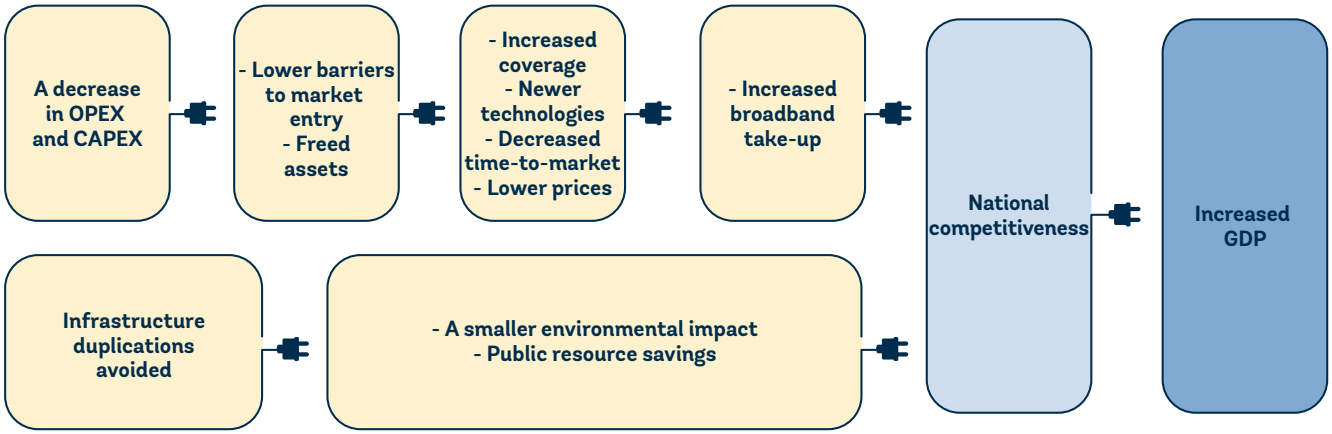
>> **Affordability.** Infrastructure deployment and its maintenance costs rest on the shoulders of end users. Naturally, the cost of the backbone network (construction and maintenance) is only one component (though significant) in the whole cost structure of the final retail broadband price, which depends on many factors, such as other cost elements, demand for the service, pricing policies, and regulatory or competitive pressures. However, the possibility of reducing the cost of the backbone network already offers some flexibility in adjusting retail prices and providing a potential spin: "lower retail prices -> higher demand -> increased usage -> lower costs per customer (meaning additional resources for network expansion or further price competition)." Recent examples from New Zealand show that almost 90 percent of wholesale price reductions have been passed on to residential consumers.[15]

>> **Public benefits, environmental impact.** Sharing infrastructure can also reduce public infrastructure expenditure by avoiding unnecessary network duplications and multiple civil works. Traditionally, utilities are operating in a strict regulatory environment with regulated prices and rates of return. Therefore, big infrastructure deployment projects usually require not only an approval from a regulator, government, or municipality, but also significant financial support (through different funds, public loans, and so on). Avoiding network duplications and multiple civil works may help to save these public funds for other important public needs (such as health care, education, and so forth). Infrastructure sharing also has a positive environmental impact by reducing the carbon footprint (through materials, energy, and emission

[12] Andrea Faggiano and others, "Utilities' Contribution to National Fiber Development" (Paris: Arthur D. Little, 2017), http://www.adlittle.com/sites/default/files/viewpoints/adl_utilities_contribution_to_fiber_deployment.pdf.
[13] Ibid.
[14] M. Andrews, M. Bradonjic, and I. Saniee, "Quantifying the Benefits of Infrastructure Sharing," Researchgate, June 2017, https://www.researchgate.net/publication/317673723_Quantifying_the_Benefits_of_Infrastructure_Sharing.
[15] Glimp, "Cheaper Broadband Prices for Consumers" (Auckland: Glimp, 2017), https://www.glimp.co.nz/blog/cheaper-broadband-prices.

savings).[16] Some analyses[17] suggest that up to 36 percent of fiber networks' annual carbon footprint can be reduced by using existing infrastructure for fiber network deployment.

Figure 1 Potential Benefits of Infrastructure Sharing



Source: Authors.

1.3.

Engagement of utilities

The engagement of utilities (gas, transport, electricity) in infrastructure-sharing activities is usually driven by two factors:

External (governmental or regulatory) pressure. Countries that have clear strategic objectives for broadband development usually realize infrastructure sharing's potential in helping them to achieve their information goals. They do so by formulating appropriate policies that encourage or mandate infrastructure sharing. Utilities are frequently covered under the scope of such policies, as typically they already have extensive passive infrastructure or privileged rights-of-way (ROW) for building new structures, which makes deployment much faster and may reduce installation costs significantly. Furthermore, utilities, especially electricity companies, are not newcomers in deploying communication networks, which they need for internal operations. For example, TSOs use ICTs for process monitoring, grid management, automatic emergency shutdown, maintenance and security systems, internal communications, data transfer and storage, billing, and corporate information technology (IT) networks. Since fiber optics are a prevalent cable technology (see box 1), telecom operators can reuse the existing infrastructure while optimizing their networks and saving the cost of deploying new ones. A number of utilities around the world are stepping in to fill the gaps left by telecom players (see "Toolkit on Cross-Sector Infrastructure Sharing"[18] for detailed case studies and examples).

[16] Deloitte and APC, "Unlocking Broadband for All: Broadband Infrastructure Sharing Policies and Strategies in Emerging Markets" (New York and Melville, South Africa: Deloitte and Association for Progressive Communications, 2015), https://www.apc.org/sites/default/files/Unlocking%20broadband%20for%20all%20Full%20report.pdf.

[17] A. S. G. Andrae and G. Griffa, "Carbon Efficiency Evaluation of FTTx Deployment," Huawei Communicate 57 (2010), https://www.huawei.com/mediafiles/CORPORATE/PDF/Magazine/communicate/57/HW_076453.pdf.

[18] Macmillan Keck and Columbia Center on Sustainable Development, "Toolkit on Cross-Sector Infrastructure Sharing" (New York: Macmillan Keck and Columbia Center on Sustainable Development, 2017), http://pubdocs.worldbank.org/en/307251492818674685/Cross-Sector-Infrastructure-Sharing-Toolkit-final-170228.pdf.

BOX 1. Fiber Optics in Electrical Networks

Electric utility companies are increasingly applying fiber optics in their communication systems. Optical ground wire (OPGW) is one of the most common cable technologies used by power utilities (including TSOs in the Western Balkans). Fiber networks offer reliability, a major requirement for the industry, as being less susceptible to outages is very important to electricity companies.

As fiber optic cables are made out of very strong and resistant material, they are not vulnerable to extreme weather conditions. **Optical fiber is also quite economical for electric utilities**, since they already own rights-of-way (ROW) and power poles, making it possible for them to install fiber optic cables alongside their existing overhead power lines (OHLs) and power poles.

Utilities could lower the cost of fiber network deployment through the reuse of spare infrastructure. Furthermore, the infrastructure a utility uses to offer its core electrical services is generally very similar to the fiber network architecture. **Electric utilities are therefore well positioned to play a complementary role in national fiber network development.**

Source: Authors.

Internal drivers (cost optimization and revenue diversification). Oftentimes utilities (such as gas, water, electricity companies) are state- or municipality-owned companies, basically providing regulated services. As they are facing significant pressure to keep costs and service prices low, any investments or additional costs must be well founded and communicated to regulators. For example, the role of fiber optics as reliable communication infrastructure for grid management needs to be clearly formulated, understood, and, in some cases, approved by a regulator.[19] The benefits of infrastructure sharing and its potential to lower existing costs may simplify the process.

Furthermore, utilities, particularly the electricity sector, are facing the challenge of declining revenue as electricity consumption flattens due to increasing energy efficiency, more distributed generation, and less energy-intensive industries. The revenue diversification offered by infrastructure sharing thus becomes an attractive option. In mature markets, a utility could make up to 20 percent of its revenue from infrastructure sharing, depending on the chosen business model.[20] The variety of services may range from rough dark fiber service provisioning to data traffic transit in the wholesale market or the provision of final broadband services on a retail level. Retail business models are richer in revenue contribution but not necessarily in profits, [21] a possible reason why utilities prefer to be engaged as wholesale-only providers. For example, Northpower Limited, an electricity company operating in New Zealand, has implemented the active wholesale model for its Ultrafast Fiber and now has more than 45 service providers on its networks. Open Fiber in Italy (owned by Enel Group) seems to be following the same approach.[22] There are other successful examples around the globe. Moreover, some experts[23] think that wholesale-only business has great potential, as the availability of dark fiber will become even more critical for mobile operators when they upgrade to 5G technologies. The 5G system uses higher frequencies with a lower range and therefore requires a build-out of additional base stations over time, especially in densely populated areas; it is therefore likely to require the deployment of fiber to the vast majority of base stations (more than 90 percent) in comparison to today's networks.[24]

In sum, infrastructure sharing may result in a "win-win" situation, where society/government wins by saving public funds and avoiding the unnecessary duplication of infrastructure, utilities win by lowering the cost of installing infrastructure they will need anyway, and telecom operators win by optimizing their networks and concentrating their investments on "last mile" access, retail operations, and greater customer satisfaction (while limiting their upfront investments in fiber deployment).

Of course, what looks good on paper usually faces challenges in the real world. Companies (utilities and telecom operators) have different approaches to network planning, use different vendors, and manage their networks differently. Sharing their infrastructure requires a delicate intervention to ensure that their partnership

19 Faggiano and others, "Utilities' Contribution to National Fiber Development."

20 Ibid.
21 Ibid.
22 Ibid.
23 I. Godlovitch and T. Gantumur, "The Role of Wholesale Only Models in Future Networks and Applications" (Bad Honnef, Germany: WIK Consult, 2018), https://www.stokab.se/Documents/Nyheter%20bilagor/The%20role%20of%20wholesale%20only_WIK.pdf.
24 Ibid.

is sustainable and acceptable to all parties.[25] Utilities often lack sufficient telecom capabilities in terms of human resources and expertise, not only in planning, design, construction, operations, and maintenance but also in commercial activities. Simply put, utilities often lack personnel who understand how to make money out of spare resources, and they also often face their own specific challenges, such as safety requirements for installing fiber networks with minimum interruptions to their core business.[26] Last but not least, utilities first have to comply with the requirements and regulations of their sector—for example, the approval of investment plans by the energy regulator in order to ensure that their primary service (electricity, for example) remains affordable. These challenges often make utilities reluctant to engage in infrastructure-sharing activities.

1.4.

Main objectives of the "Balkans Digital Highway" pre-feasibility work

The World Bank's "Balkans Digital Highway" initiative has pursued its pre-feasibility work, as described below, with the overall objective of determining whether it is worthwhile to pursue national and especially regional infrastructure sharing and thus proceed with actual feasibility studies:

- to scope out existing demand and business opportunities in the wholesale markets, both national and cross-border/regional, for using the excess capacity available on the existing fiber optic ground wire networks, installed alongside the power grids and operated by TSOs in the six Western Balkan countries, as a way to generate additional income
- to take detailed stock of existing excess optical ground wire (OPGW) capacity on the TSOs' networks, including cross-border networks, from a technical standpoint
- to determine what changes are required in the national telecommunications and energy frameworks within each country to operationalize infrastructure sharing
- to determine a plan of action on how to realize infrastructure sharing in the entire Western Balkan region based on the technical, organizational, and regulatory bottlenecks identified in each country

In the pursuit of these objectives, the World Bank has cooperated with all the Western Balkan TSOs and all the relevant private, public, and other stakeholders, including regional organizations.[27] The list of participants and stakeholders is provided in **Annex 1.**

This analysis is based on information obtained:

i) directly from stakeholders (questionnaires were sent to all relevant stakeholders)[28]
ii) from secondary sources and publicly available information (reports from international institutions, such as the International Telecommunication Union [ITU], EC, and World Bank, and from national institutions, such as ministries, regulators, and national statistical offices)
iii) from national and EU legislation
iv) from discussions with experts, including direct interviews with all incumbent operators in the Western Balkan region, international carriers, and others

The data were collected, and secondary sources and available public information analyzed between April 2017 and January 2018. For the purpose of creating a technical inventory of the TSOs' existing and planned OPGW in the Western Balkans, a simplified Geographic Information System (GIS) was used. The analytical tool EleGIS was designed to develop infrastructure maps. EleGIS was provided with data received from TSOs and data (geographical locations of the TSOs' facilities) found during the course of the research.

The pre-feasibility work for the "Balkans Digital Highway" initiative was financed by the Public-Private Infrastructure Advisory Facility (PPIAF). PPIAF is a multi-donor technical assistance facility financed by 17 multilateral and bilateral donors: the Asian Development Bank, the European Bank for Reconstruction and Development, the International Finance Corporation, the Millennium Challenge Corporation, the World Bank, and the governments of Australia, Austria, Canada, France, Germany, Netherlands, Sweden, Switzerland, the United Kingdom, and the United States. PPIAF provides technical assistance to governments to support the creation of a sound environment enabling the private sector to provide basic infrastructure services.

[25] M. Paolini, "The Benefits of Infrastructure Sharing," FierceWireless, June 29, 2010, https://www.fiercewireless.com/tech/paolini-benefits-infrastructure-sharing.
[26] Faggiano and others, "Utilities' Contribution to National Fiber Development."

[27] These include the Energy Community and the Regional Cooperation Council.
[28] Over 1,000 e-mails and over 500 phone calls were exchanged.

II. PRINCIPAL RESULTS OF THE PRE-FEASIBILITY STUDIES

2.1.

Demand analysis

One of the initial tasks of the pre-feasibility work was to evaluate the potential demand for infrastructure-sharing services. Knowing that this demand comes mainly from two sources—retail demand for ICT services, in particular for broadband services, and demand from other market players for network capacities—the work has focused on:

- providing a general market analysis of the broadband market in the Western Balkans, including the main indicators, the primary market players and their market shares, broadband technology splits, and the intensity of service usage, as well as socioeconomic indicators influencing the broadband market and a forecast of broadband dynamics for the period 2018–23.
- providing an overview of the potential demand (and also competition) from the wholesale level, that is, the main national market players, their independence in terms of infrastructure deployment, and any unserved needs from local, national, or international carriers. The results were used to forecast the potential demand for the infrastructure-sharing services of TSOs in the Western Balkans.

ICT market in general. The countries of the Western Balkans are at different stages of ICT development. This development can be analyzed based on several parameters, such as the penetration of fixed telephone subscriptions, mobile cellular subscriptions, fixed (wired) broadband subscriptions, mobile broadband subscriptions, the relative share of households with a computer, and so forth. In order to avoid possible methodological differences in statistics, an aggregated index of ICT development—the ICT Development Index (IDI) of the ITU—was used. This index includes different measures of ICT infrastructure, usage, and skills. The ICT Development Index indicates that compared globally, the Western Balkan countries are at a middle level of ICT sector development, with Serbia having made the most progress and Albania the least[29] (see table 2).

Table 2 Western Balkans: IDI Comparison with Developing and Developed Countries (2016)

			Developing countries	Albania	Bosnia and Herzegovina	Republic of North Macedonia	Kosovo	Montenegro	Serbia	Daveloped countries
IDI score:			**4,30**	**5,18**	**5,43**	**6,05**	**5,47**	**6,79**	**6,90**	**8,06**
	Ideal value	weight								
ICT Readiness	**1**	**0,4**	**4,96**	**4,89**	**5,93**	**6,75**	**6,27**	**7,92**	**7,82**	**8,40**
Fixed-telephone subscriptions per 100 inhabitants:	60	0,2	8,5	7,8	19,5	17,5	3,4	23,8	39,1	38,1
Mobile-celular subscriptions per 100 inhabitants:	120	0,2	96,3	105,1	89,2	100,7	97,7	167,5	128,5	127,3
International internet bandwidth per internet user (kbit/s):	977	0,2	53	57	99	109	80	203	193	140
Households with computers (%):	100	0,2	34,4	27,7	49,2	69,8	71,5	58,2	65,8	81,5
Households with internet acces (%):	100	0,2	40,4	37,0	57,1	70,4	73,1	69,8	64,7	82,9
ICT Use	**1**	**0,4**	**3,24**	**4,43**	**4,52**	**5,36**	**3,67**	**5,38**	**5,96**	**7,48**
Individuals using internet (%):	100	0,33	39,0	66,4	69,3	72,2	51,1	69,9	67,1	79,6
Fixed (wired) BB subscriptions per 100 inhabitants:	60	0,33	8,7	8,3	17,4	17,9	11,9	18,5	23,9	30,3
Active mobile BB subscriptions per 100 inhabitants:	100	0,33	43,6	52,6	37,4	59,0	39,2	60,7	71,9	94,4
ICT Capacity	**1**	**0,2**	**5,08**	**7,26**	**6,23**	**6,03**	**7,48**	**7,36**	**6,96**	**8,53**
Mean years of schooling:	15	0,33	7,4	9,6	9,0	9,4	10,8	11,3	10,8	11,7
Secondary gross enroiment ratio:	100	0,33	74,9	95,8	89,3	78,6	94,3	90,3	88,2	109,8
Tertiary gross enroiment ratio:	100	0,33	28,3	58,1	37,7	39,6	58,1	55,3	48,4	68,2

Source: ITU, "ICT Development Index,"2017, https://www.itu.int/net4/ITU-D/idi/2017/index.html; for Kosovo, the IDI index was supplemented with national data.

29 Serbia is ranked as 51st country out of 175 countries. Albania, on the other hand, is in 91st place.

Broadband market in the Western Balkans. People can access the internet through two basic ways: through a fixed broadband connection at home or elsewhere (in the building) and via a wireless connection on a cell phone or tablet. At the initial stages of broadband market development when demand had not yet escalated, both fixed and mobile technologies were perceived as interchangeable. However, over time, fixed technologies started to play a critical role in providing the guaranteed high-speed connections to institutions and households that mobile networks could not offer. Looking ahead, mobile broadband technologies are evolving and with introduction of 5G, high-speed connections can be ensured. Ironically deployment of 5G will rely on fixed fiber infrastructure that shall be linking most of the elements in the 5G network (incl. antennas). Thus, over time, both technologies (and infrastructures) became complementary to each other and are considered to be essential national assets.

The analysis has revealed that the currently moderate (and in some cases stagnating) growth of mobile and fixed penetration and the quality of services are limited by the existing infrastructure. Moreover, further growth would require both greenfield deployments and infrastructure upgrades. For instance, fiber connections to the towers and antennas in mobile networks are critical prerequisites to the rollout of 5G services. Similarly, the technical viability of offering high-speed fixed connections to households and institutions will be determined by the footprint of the fiber networks. The analysis has also confirmed the differences in the penetration levels of both fixed and mobile broadband access among and within Western Balkan countries. Key observations include:

>> **The mobile sector is predominant in all six Western Balkan countries, as mobile penetration is high and has started to reach its saturation point.** On average, mobile penetration in the region stood at 114 percent at the end of 2016. The highest was registered in Montenegro (167 percent) and the lowest in BiH (97 percent). However, the gap between mobile and mobile broadband penetration is still significant in all the countries studied, thus showing the potential for future growth. The mobile broadband penetration in the Western Balkans was 55 percent on average at the end of 2016. The biggest gap can be seen in BiH, where only 38 percent of active mobile users are using the mobile internet, most likely because the deployment of new generation mobile networks has been delayed there. The highest mobile broadband penetration is around the capital cities, where coverage of 3G and 4G networks is better. No country in the Western Balkans has yet begun the testing or commercial exploitation of 5G technology. The introduction of this technology will require significant infrastructure investments in all parts of the mobile network.

>> **It can be concluded that the private sector–led penetration of fixed broadband connections has been saturated.** In most Western Balkan countries, fixed broadband penetration is stagnant—its growth is slow or slowing down. Nationally, higher fixed broadband penetration may be observed in more concentrated areas around the main cities, as geographical factors and socioeconomic indicators are not conducive to its being evenly spread throughout an entire country. In rural areas, alternative (not fixed broadband) technological solutions prevail, indicating that thus far, commercial (that is, without public co-financing) fixed broadband deployments are not viable. **Fiber-to-the-x (FTTx) access growth is driven by infrastructure improvements that are in turn driven by competitive pressure, while greenfield FTTx deployments are rare. This implies that the current FTTx infrastructure footprint is not increasing.** The number of users of FTTx access is doubling every year, but its access technology share ranges from only 0.1 percent in BiH to 11 percent of total broadband connections in Albania.

>> **End users in the majority of Western Balkan countries are paying relatively high prices (measured in GNI per capita) to get fixed broadband access.** It could be assumed that the fixed broadband penetration rate would increase as residents' incomes increase and/or the price for services decreases.

>> **The average internet speed varies widely from country to country and within countries.** At the time of this writing, the highest average speed was recorded in Serbia (14.4 Mb/s), while the lowest was in Albania (3.2 Mb/s). The differences in the average internet speeds are similarly very high within the countries of the Western Balkans. The data collected indicate that on a regional level, the highest average speed was recorded in the North Banat District of Serbia (17.8 Mb/s) and the lowest in Berat County in Albania (only 0.2 Mb/s). Providers of fixed broadband services offer users high-speed subscription packages but do not guarantee speeds. Differences between the advertised and actual broadband speeds are among the main complaints in most of the countries studied.

Table 3 Western Balkans: Fixed Broadband[30] Internet Penetration (per Household), Forecast, and Growth

	2016			2023		
	HHs (million)	Subscribers (million)	Penetration (%)	Subscribers (million)	Penetration (%)	CAGR (%)
Albania	0,72	0,27	36,9%	0,40	55%	5,9%
Bosnia and Herzegovina	1,16	0,66	57,0%	0,69	59%	0,6%
Kosovo	0,32	0,24	73,9%	0,31	95%	3,6%
Republic of North Macedonia	0,58	0,38	65,6%	0,45	77%	2,4%
Montenegro	0,19	0,11	58,9%	0,13	67%	1,8%
Serbia	2,47	1,44	58,3%	1,98	80%	4,6%

Source: Telecommunications agencies of the Western Balkan countries, 2016.

Table 4 Western Balkans: Mobile Broadband[31] Internet Penetration, Forecast, and Growth

	2016			2023		
	Population (million)	Subscribers (million)	Penetration (%)	Subscribers (million)	Penetration (%)	CAGR (%)
Albania	2,78	1,57	56%	2,94	106%	9,4%
Bosnia and Herzegovina	3,52	1,32	38%	2,88	82%	11,7%
Kosovo	1,82	1,24	68%	1,98	109%	7,0%
Republic of North Macedonia	2,08	1,19	57%	2,12	102%	8,6%
Montenegro	0,62	0,37	60%	0,89	143%	13,3%
Serbia	7,06	4,85	69%	8,31	118%	8,0%

Source: Telecommunications agencies of the Western Balkan countries, 2016.
Note: Methodology of EKIP (Montenegro's telecommunications agency) differs from other telecommunications agencies, hence ITU data for Montenegro in 2016 were used (marked in blue).

Expected growth over the next several years in the Western Balkans will be driven by the higher affordability of services and increased network accessibility. However, this will require investments in technology to enable the countries, especially BiH and Albania, to keep up with the rest of Europe. To achieve the policy goals while responding to key socio-demographic and economic projections, the Western Balkan countries need to reevaluate the ability of their current networks to absorb the projected demand for broadband and to (re)define their action plans. The private sector might require public support to cover the less profitable areas in order to address the urban-rural divides within countries. This is precisely where infrastructure sharing may play an essential role.

Potential demand at the wholesale level stems from the main national market players and their networks. At first glance, it may appear that telecom operators, with their own infrastructure, do not have any demand for TSOs' infrastructure-sharing services. This is true, as long as the former have complete and far-reaching infrastructure, which is rarely the case, especially in rural, unprofitable areas. Furthermore, today, when quality of service is one of the key measures for competition, operators often want to have some backup capacity. For this reason, telecommunication providers usually deploy redundant (backup) networks (in rings, for example) to have various alternatives operating in parallel, which, again, are expensive to own. Telecom operators are thus not only competitors to TSOs in the market of wholesale broadband services but also potential customers (at the wholesale level).

The second wave of the privatization of the telecommunications sector in the Western Balkans allowed foreign carriers to enter the national telecommunication markets. These commercial companies have

30 Fixed broadband refers to fixed access to the public internet at speeds equal to or greater than 256 kbit/s in one or both directions.
31 Mobile broadband refers to mobile access to data communications (e.g., the internet) at speeds greater than or equal to 256 kbit/s in one or both directions.

their own regional (e.g., Telekom Slovenije, Telekom Srbije, Telemach), international (e.g., Telenor, Telekom Austria), or global (e.g., Deutsche Telekom, Vodafone) footprint. All of these carriers have a strong presence in the Western Balkans. Some have managed to acquire or build their own fiber optic networks in the countries in which they operate (e.g., Telekom Slovenije, Telekom Srbije, Telemach, Deutsche Telekom, Telenor); however, others (e.g., VIP.mobile in Serbia, Vodafone in Albania) have chosen to rent fiber optic networks to complete their networks. In addition, there are roughly 250 local ISPs in the region whose activities basically depend on the availability of wholesale broadband services. In the Western Balkans, local ISPs play a critical role in providing internet access in rural locations; usually they are the first to move into remote villages. In many instances, their services are a valuable alternative to the incumbent operators' offerings. During the pre-feasibility work, it was determined that local ISPs are particularly in demand for alternative wholesale broadband services.[32]

According to estimations, the current size of the Western Balkan wholesale broadband market is at least €37 million, which is about 1.2 percent of the total electronic communications market of the EU (see table 5). For the purposes of this evaluation, providers with their own backbone optical network were considered, regardless of whether they offer access to that network on the market or use it exclusively for their own needs.

Table 5 Western Balkans: Overview of Wholesale Broadband Market Size

	Wholesale BB market		EC market	
	size [€ million]	share [%]	size [€ million]	share [%]
Albania	1.8	4.7%	252	8.1%
Bosnia and Herzegovina	6.8	18.1%	716	23.0%
Kosovo	1.5	4.0%	168	5.4%
Republic of North Macedonia	2.5	6.8%	283	9.1%
Montenegro	1.7	4.5%	152	4.9%
Serbia	23.3	61.9%	1,544	49.5%
Total	**37.6**		**3,116**	

Source for electronic communications market size: National Regulatory Authorities (NRAs) of the Western Balkan countries for 2016.
Note: Estimation of the wholesale broadband market size is based on data on the total quantity/length and prices of fiber optics (dark fiber) provided and collected during the market research.

Analysis has confirmed that although competition in the wholesale broadband market exists, it is not sufficient, as in every country there is at least one market player that has at least half of the market or more. The table below provides the Herfindahl-Hirschman (HHI) estimation based on the length[33] of the backbone optical cables of the wholesale broadband providers in each country. The calculated value of the HHI is highest in North Macedonia and Serbia, indicating the weakest level of competition among the wholesale broadband service providers in those countries. The lowest value of the HHI is in Montenegro, indicating that competition on the wholesale broadband services market is more evenly distributed.

The potential entry of TSOs into the market (increasing supply by bringing their fiber assets) would have a positive transformative impact on wholesale broadband markets in the Western Balkans. In terms of the HHI, the concentration index would undergo the greatest adjustment in Serbia and North Macedonia and only a relatively small one in Montenegro.

32 This is the case for all Western Balkan countries and is especially true in Albania.

33 This approach is indicative and accounts for the fiber used by many carriers for their own purposes. However, it provides good initial understanding of the situation in each country's market.

Table 6 Western Balkans: Current Wholesale Broadband Services Concentration (HHI) Index (without and with the potential participation of the TSO)

	existence of competition	competitor 1 market share	competitor 2 market share	competitor 3 market share	HHI index
Albania	YES	55%	26%	11%	0.39
Bosnia and Herzegovina	YES	50%	30%	20%	0.38
Kosovo	YES	55%	30%	10%	0.40
Republic of North Macedonia	YES	65%	25%	6%	0.49
Montenegro	YES	50%	29%	17%	0.36
Serbia	YES	67%	16%	11%	0.49

	existence of competition	competitor 1 market share	competitor 2 market share	competitor 3 market share	TSO market share	HHI (with TSO)	difference
Albania	YES	41%	20%	8%	25%	0.19	0.20
Bosnia and Herzegovina	YES	38%	23%	15%	25%	0.18	0.20
Kosovo	YES	41%	23%	8%	25%	0.19	0.21
Republic of North Macedonia	YES	49%	19%	5%	25%	0.22	0.27
Montenegro	YES	38%	22%	13%	25%	0.18	0.19
Serbia	YES	51%	12%	8%	25%	0.22	0.27
Ideal situation	YES	25%	25%	25%	25%	0.17	0.17

Source: Networld Consulting, "Regional Broadband Market Study," Report for the Balkans Digital Highway, 2018 (Unpublished).
Note: The calculation is made based on the estimation of the relative share (i.e., the length of the optical cable leased by a provider divided by the total length of the optical cable leased in a country) of the leased backbone optical cable of the wholesale broadband providers/competitors. The data came from wholesale broadband providers/competitors, NRAs, and clients of broadband providers.

According to a forecast of the market up to 2023, the size of the Western Balkan wholesale broadband market may potentially decrease to around €29 million. The biggest share is projected to remain in Serbia, where the total share of the market is likely to fall to €16 million, or roughly 55 percent of the market. The second biggest wholesale broadband market will likely remain in BiH, with an absolute value of almost €6 million and a share of around 22 percent. Next is North Macedonia, with an absolute value of more than €2.4 million and a share of around 8 percent. The size of the Albanian, Montenegrin, and Kosovan markets is likely to range between €1.5 and €1.7 million (in the relative value of 4.8 to 5.7 percent of the total Western Balkan wholesale broadband market). The Western Balkan wholesale broadband market will likely represent a bit more than 1.1 percent of the total electronic communications market of the EU (table 7).

Table 7 Western Balkans: Forecast of Wholesale Broadband Market Size in 2023

	Wholesale BB market		EC market	
	size [€ million]	share [%]	size [€ million]	share [%]
Albania	1.7	5.7%	227	8.1%
Bosnia and Herzegovina	5.7	22.1%	600	23.0%
Kosovo	1.5	4.8%	146	5.4%
Republic of North Macedonia	2.4	8.1%	246	9.1%
Montenegro	1.5	5.0%	132	4.9%
Serbia	16.2	54.2%	1,203	49.5%
Total	**28.9**		**2,554**	

Note: Estimations are based on Networld Consulting methodology (2018),

There are several reasons for this, most importantly the decrease in wholesale prices. Due to competitive pressure, prices of wholesale broadband access are falling globally, starting with the mature telecommunications markets. This trend is likely to advance into the Western Balkan countries. Wholesale broadband (including fiber optics) prices are also likely to fall if a new big market player were to enter the market in each country—that is, a TSO.

On the other hand, it is important to emphasize that the demand for dark fiber services is going to increase, primarily because of the more rapid development of mobile broadband than fixed broadband access. Mobile broadband access is going to proliferate, and the steady growth of the average broadband connection speed will follow. At the same time, broadband penetration in the fixed networks will grow moderately, and the average broadband download speed per user will rapidly increase. External factors will play a role. Plenty of large international internet carriers are still not present in the Western Balkans, though they are operating in several EU countries, including those neighboring the Western Balkan region. However, their fiber-optic backbone networks (either owned or leased) are somehow bypassing the Western Balkans. This is likely because, among other reasons, telecommunications policies are not sufficiently transparent, the leasing prices of the fiber optic backbone network are too high, the countries' fiber optic networks are fragmented and not unified, and there are insufficient business opportunities. If the situation were to improve, Western Balkan countries could expect the larger international internet carriers to move into their region also.

Additional factors affecting the increased traffic and network capacity requirements are the performance of the internet exchange points (IXPs), the number of high-quality data centers in a country, and of course, the content delivery networks (CDNs). CDNs and data centers are particularly important sources of demand for high-speed broadband that would need to be supported by reliable national and regional backbones. At the moment, these factors are not putting significant pressure on the networks in the region, but this will change over time. Currently, the performance of IXPs in the Western Balkans is weak, and the majority of the data centers are technologically incomplete. The CDNs are still relatively inadequately developed in most of the countries, with the exception of Montenegro. Based on the data obtained, as far as the wider Balkan region is concerned, CDNs are indeed sufficiently developed only in Romania. This area is expected to develop relatively quickly, however, especially in countries with their own strong production (video) content, sound international internet connections, and better knowledge of foreign languages, among other factors.

TSOs may consider some of these activities (IXPs, CDNs, data centers) to be reliable sources of additional revenue in the future. For example, in Lithuania, the company that operates the TSO's fiber network (Data-Logistics) is also engaged in the business of data centers, building advanced centers and selling their capacities to strategic national and international companies, such as banks, larger organizations, or even TSOs and distribution system operators (DSOs).

To sum up, whereas the majority of Western Balkan countries (Albania, Kosovo, Montenegro, and North Macedonia) experienced their peak revenue from telecommunications services several years ago, others (BiH and Serbia) are only now encountering it, and operators are or will soon be facing a fall in revenue from this industry. This trend inevitably forces operators not only to optimize their operating expenditures (OPEX) but also to shrink their capital expenditures (CAPEX). It will also force them to think about the use of the shared infrastructure and fiber optic network of the TSO as a potential "win-win" option.

In the course of this study, the following groups of potential clients were identified that would likely be interested in the fiber optic networks of TSOs:

(1) Initially, demand is likely to come from the following groups of telecom operators: i) local ISPs who need only a point of presence (PoP), ii) regional operators that may need alternative connectivity between cities/regions/districts/counties/countries; and iii) alternative operators that are currently leasing dark fiber at unfavorable prices and/or unfavorable conditions, mostly from incumbent telecommunications operators that are owners of most of the widespread fiber optic networks in Western Balkan countries;

(2) Demand might also come from incumbent telecommunications operators looking for the deployment of redundant (backup) network (segments) and alternative physical paths, including international paths;

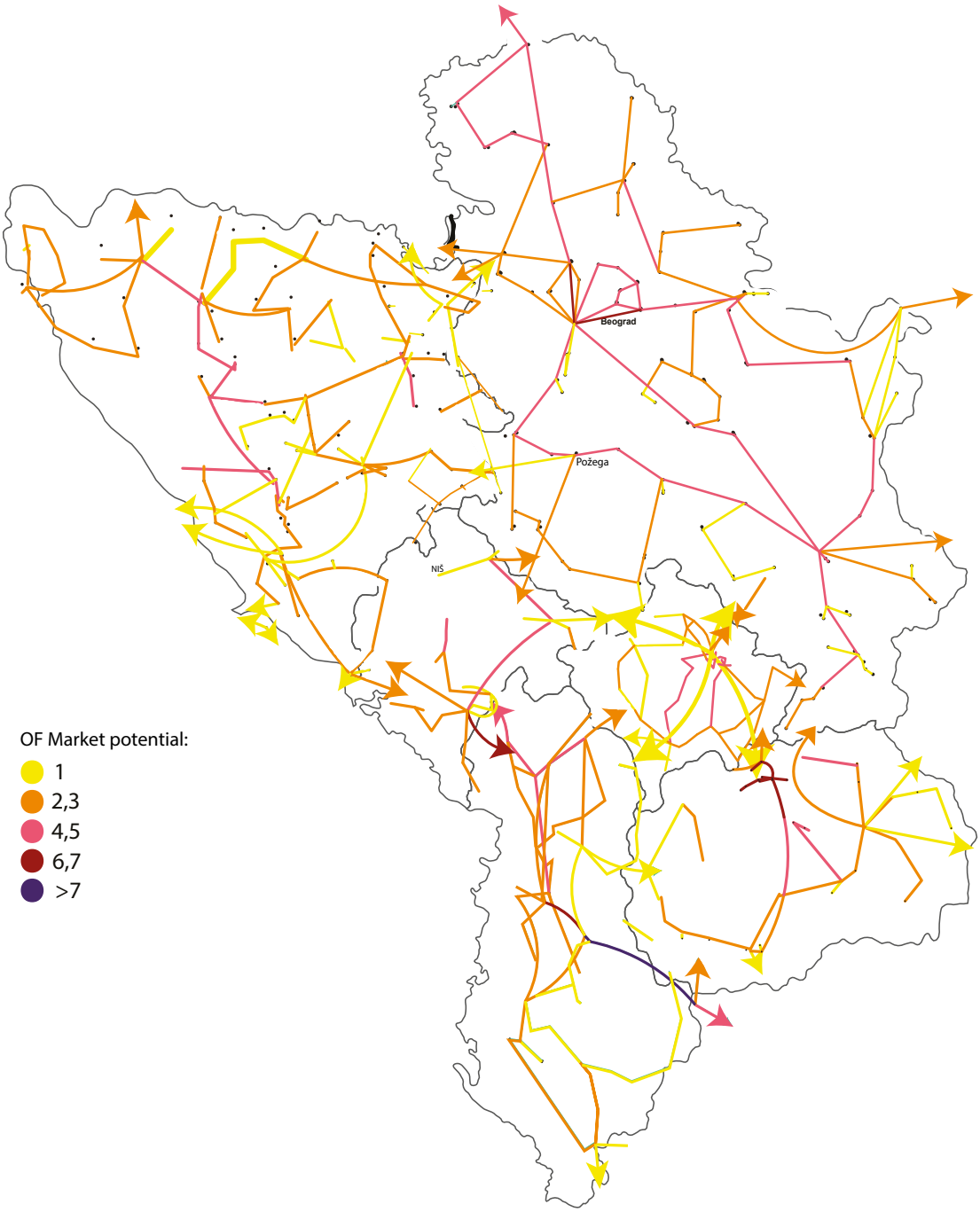
(3) Demand from international operators is then likely to follow, including those with a commercial interest in the Western Balkans or those transiting internet provider traffic through the region;

(4) Finally, demand might come from the public/private non-telecom sector actors, including but not limited to: i) academic and research networks of Western Balkan countries that require connectivity for universities, schools (both primary and secondary), and research institutions, ii) governments and state administrations that require connectivity for their agencies, iii) banks that are facing strict regulatory rules about the safety and reliability of their dedicated networks' connectivity, and iv) big companies that will otherwise need to deploy their own private networks, connect supercomputers to their research and development centers, or provide access to centralized data centers.

The pre-feasibility work has determined that there is currently considerable demand for infrastructure sharing among TSOs that will continue well into the future.

The analysis estimated that the highest market potential for the fiber optic cables of TSOs (see figure 2) would be in the network segments near all the capitals of the Western Balkan countries and those along the main transport corridors (for example, Podgorica – Tirana – Elbasan – border with Greece, border with Hungary – Subotica – Novi Sad – Belgrade – Skopje, border with Croatia – Banja Luka – Sarajevo, and so on). Several of the Western Balkan countries are located at the crossroads of pan-European corridors and this will, if there is fair and transparent regulation, very likely pull in the most prominent international carriers that are currently bypassing the Western Balkans.

Figure 2 Western Balkans: Market Potential of TSOs' Fiber Optic Networks



Source: Networld Consulting (2018).

2.2.

TSO infrastructure

The basic task of TSOs is transmitting electricity and providing system services for a complete electric power system. With a professional approach, know-how, and advanced technology, TSOs in the Western Balkans provide safe, reliable, and uninterrupted electric power transmission both within their countries and across borders. Not only are they extending specialized subsystems throughout their networks, they are also laying optical networks along their core business networks, high-voltage overhead power lines (OHL), substations, and electric poles. By combining multiple service networks on a converged optical fiber platform, electric utility companies are improving reliability and security while reducing network complexity.

A technical inventory of TSOs' infrastructure estimated that overall, Western Balkan TSOs have a total of roughly 25,000 kilometers of high-voltage networks that have integrated OPGW cables at a total length of around 15,500 kilometers. This means that, on average, approximately 64.4 percent of the high-voltage electricity grid is equipped with an OPGW network (between 50 percent in Serbia[34] and up to 82.8 percent in BiH):

- In Albania, OST has 2,002 kilometers of OPGW network installed. OST plans to develop interconnections with North Macedonia, thus completing OPGW interconnections with all neighboring countries.[35]
- In BiH, Elektroprenos/Elektroprijenos has 5,233 kilometers of OPGW network installed and several OPGW interconnections with all neighboring countries.[36]
- In Kosovo, KOSTT launched infrastructure-sharing services in 2017. Its fiber optic network consists of 57 segments with a total length of 1,109 kilometers. Kosovo and Serbia have an operational OPGW interconnection and it is used for TSO data exchange for the observability area.
- In Montenegro, CGES already provides wholesale services by leasing optical fibers and other infrastructure to the telecom sector. The capacity of its 689 kilometer-long OPGW cable is 48 fibers of two types. CGES interconnects with electricity companies in Albania, BiH, Kosovo, and Serbia.[37]
- In North Macedonia, MEPSO has built 1,385 kilometers of OPGW cable with interconnections to Bulgaria, Greece, Kosovo, and Serbia and plans to develop interconnections with Albania.[38]
- In Serbia, EMS/EPS has built around 5,000 kilometers of OPGW cable with interconnections to Bulgaria, BiH (Republika Srpska), Croatia, Hungary, North Macedonia, Montenegro, and Romania.[39] Kosovo and Serbia have an operational OPGW interconnection and it is used for TSO data exchange for the observability area.[40]
- It is estimated that only 35 percent of the total capacity of all the TSOs' fiber optic networks in the Western Balkans is currently being utilized.

There are many gaps (including international links) in the high-voltage electricity networks of the regional TSOs. Understanding the importance of closing these gaps, TSOs have included the construction of relevant high-voltage electricity lines in their short-, medium-, and long-term plans (figure 3).

Similarly, there are many gaps in TSOs' optical networks—in fact, there are more gaps in these networks than in their high-voltage electricity networks. Even though the TSOs are aware of the importance of telecommunications networks to the functioning of the entire high-voltage electricity transmission system, the closure of these gaps remains on the back burner. Governments and regulatory bodies clearly have an important role to play here; by looking at the bigger picture (national or even international), they can formulate what they expect from TSOs. This would ease and smooth the consideration of investments and help to close the network gaps.

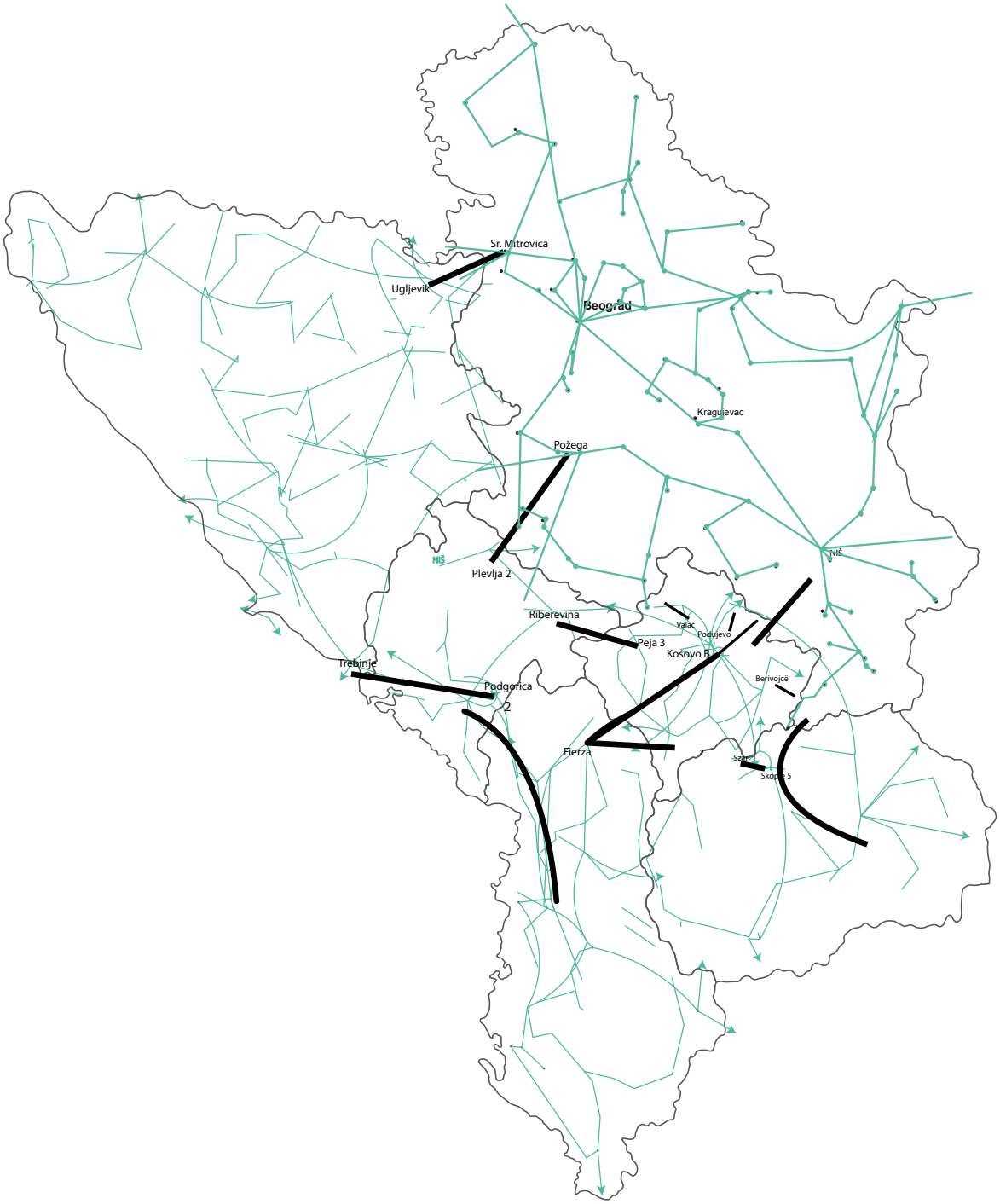
34 The required data for Serbia were obtained but are not featured in this output due to the country's decision not to do so. This report therefore only features the information about Serbian network that was obtained from the public sources. It was also agreed that Serbia would not receive with the "Inventory of Optical Fiber Ground Wire (OPGW) in Electricity Transmission Grids" as part of the technical assistance. This report will be shared with the remaining Western Balkans countries that did not disagree to featuring their data.
35 According to OST, the TSO in Albania.
36 According to ELEKTROPRENOS, the TSO in BiH.
37 According to CGES, the TSO in Montenegro.
38 According to MEPSO, the TSO in North Macedonia.
39 Source http://www.eps.rs/Eng/Godisnji%20Izvestaji/Godisnjak_EPS_2014_07082015_en.pdf
40 According to KOSTT, the TSO in Kosovo.

On average, TSOs invested €7.4 per meter of optical network in the construction of optical networks, and these optical networks are between seven and 11 years old.[41] Unleashing OPGW sharing, which would involve hardly any capital investment, allows for the more effective use of TSO resources (fewer resources would be allocated to energy investment) while generating a new stream of income. This additional income could then be used for re-investment, for example, to enhance energy service delivery, which would have a positive impact on end users.

When this pre-feasibility work was begun, only two out of six TSOs in the Western Balkans were sharing their infrastructure (CGES and KOSST). However, during the course of the work, MEPSO (North Macedonia) announced the launch of infrastructure sharing in December 2018[42] and other TSOs have made known their intention to begin infrastructure sharing in the near future (Albania and Serbia). The current low engagement in infrastructure sharing in the region may be explained by a number of several factors that include, to varying degrees depending on the country: the absence of political support; the lack of understanding and awareness of the potential strategic importance of TSOs' OPGW networks to the development of the country's electronic communications market; regulatory uncertainty; TSO management's failure to focus on the issue; a lack of qualified staff; and the low understanding and awareness of market needs. Although these challenges need to be overcome, a technical inventory of existing excess OPGW capacity on Western Balkan energy utility networks points to the clear potential for national-level and cross-border infrastructure sharing, and those networks may be a good starting point for further development.

41 Except for OST, which was completely modernized in 2017.
42 "Zaev: MEPSO's Optical Network will Enable the Internet to Meet EU Standards," Makfax, November 25, 2018, https://makfax.com.mk/ekonomija/ (in Serbian).

Figure 3 Western Balkans: OPGW Infrastructure of TSOs



Note: This overview is based on the analyses of all six fiber optic networks of the Western Balkan TSOs. Green lines represent the OPGW networks of the Western Balkan TSOs. **Black lines** represent the interconnection points of the Western Balkan TSOs.

2.3.

Policy and regulation

Successful cross-sectoral infrastructure sharing requires not only smooth cooperation between market players but also deep collaboration at an institutional level. Taking this into account, the pre-feasibility work included a review of the six countries' national policy and regulatory frameworks in order to identify possible obstacles to infrastructure sharing. Areas of analysis included energy sector regulation, electronic communications regulation, dispute resolution, public-private partnerships (PPPs), and procurement legislation.

Infrastructure sharing is a system in which two separate sectors, with their own rules, regulations, and dynamics, start to interact. For market players involved in this complex environment, it is important to understand the rules of the game from both sides: energy and electronic communications. Energy sector regulation prescribes the conditions under which the sector's market players (TSOs, in this case) may or may not be involved in offering electronic communication services. Electronic communications sector regulation determines how these services are regulated. Dispute-resolution procedures should be clear on how the disputes between the market players in the two different sectors can be resolved and which authority or agency will be imposing these decisions and obligations, if necessary.

PPP and procurement legislation represents other possible entry or activity barriers. The first describes if there are any limitations on PPPs (which may be important in substantial infrastructure development projects), and the second determines if electronic communications activity is included in or excluded from national procurement law. Procurement legislation stipulates the rules and procedures governing how public bodies purchase work, goods, and services; if electronic communications services are not subject to this law, market players have more flexibility to act.

Energy sector regulation. The following aspects of energy sector legislation were reviewed: (i) whether energy legislation clearly lays out the conditions under which the responsible authority could decide to allow a TSO to offer electronic communications services to third parties; (ii) whether the regulation of additional revenues (not coming not from their primary activities) exists and whether these additional revenues should be treated as a part of the regulated energy revenue;[43] and (iii) whether in order to prevent cross-subsidizing, discrimination, and a distortion of competition, TSOs should keep separate accounts for each of their transmission or distribution activities.[44] The first shows the extent to which it is difficult for a TSO to engage in infrastructure-sharing activities, the second reflects on how flexible a TSO is (or could be) in managing its finances with respect to additional activities, and the third indicates the importance of transparency and the need to avoid possible market distortions.

The outcome of the review are as follows:

- All of the Western Balkan countries have made it legally possible for TSOs to engage in infrastructure-sharing activities. It is worth mentioning that North Macedonia adopted a new Energy Law that incorporates the necessary EU directives and regulations and focuses on a bottleneck in its regulatory regime that was identified during the writing this pre-feasibility study.[45]
- Decisions on the treatment of "non-regulated" (additional) revenues have to be taken in Albania and Serbia (by electricity sector regulators); in Montenegro, BiH, and Kosovo, the unregulated revenues have to be fully or partially deducted from the regulated ones.
- Separate accounting is stipulated in Albania, Montenegro, BiH, Serbia, and Kosovo.

Electronic communications sector regulation. The following aspects of legislation governing the electronic communications sector were reviewed: (i) whether ex ante regulation for wholesale broadband services exists;[46] (ii) whether there is separate accounting; and (iii) the types of licenses and authorizations needed to enter the market. These elements again reflect the presence of market entrance barriers (from the perspective of electronic communications regulation), the level of competition in the market, competition problems and regulatory instruments that are in use or are required for use,[47] and the necessary prerequisites for ensuring transparency and fair competition in the market.

[43] In other words, the question is whether the Law on Energy or the methodology stipulate how to treat the non-regulated revenue. There are several options. Some share of the regulated revenue could be deducted, leading to a decrease in the the price for electricity end users, or a portion of the revenue could not be deducted but be directly invested in the development of the electronic communications system.

[44] As required according to Directive 2009/72/EC of the European Parliament and of the Council, July 13, 2009, concerning Common Rules for the Internal Market in Electricity.

[45] Ivan Kolekjevski, "New Energy Law a Turning Point for Macedonia, Says Energy Community," MIA, October 31, 2018, https://mia.mk/2018/10/new-energy-law-a-turning-point-for-macedonia-says-energy-community/?lang=en.

[46] This was evaluated based on whether the NRAs in the Western Balkan countries define the relevant wholesale market of leased lines and imposes remedies on any identified Significant Market Power (SMP) operator(s) according to the EU's recommendation from 2003.

The outcomes of the review are as follow:

>> **Wholesale broadband services (as defined for the purpose of the pre-feasibility studies, i.e., dark fiber) are not regulated ex ante in Western Balkan countries.** Ex ante regulation of the relevant services is not yet in place in Albania and BiH. In North Macedonia, the trunk segment of leased lines is defined as a relevant market, but dark fiber is not included in it. In Serbia, the Electronic Communications Regulator defines the wholesale relevant market for leased lines, which include both the trunk and terminating segment. Dark fiber, however, is not included in that market. In Kosovo, the Electronic Communications Regulator defines the relevant market wholesale provisioning trunk segments of leased lines, and optical fibers are included in the market. Nevertheless, the Regulator has concluded that the market was not developed enough, and imposing ex ante obligations would be premature at the moment. Thus, there are no special ex ante obligations for leasing optical fibers on the market in Kosovo.

>> **Accounting separation is in place in all Western Balkan countries.** The countries have transposed accounting separation to their respective electronic communications legislation. This requires that electronic communications be independent of the regulated energy system. Separate accounting should be imposed in the Electronic Communications Law covering electronic communications services for the companies that have special or exclusive rights to the provision of services in other sectors (e.g., electricity, in this case) to keep separate accounts for the activities associated with the provision of electronic communications networks or services.

>> **Authorization regimes differ in Western Balkan countries.** Authorization regimes vary across Western Balkan countries. In Albania, Kosovo, Montenegro, and North Macedonia, they are in line with the provisions of the General Authorization regime applied in the EU. The procedures to notify the intent to engage in the provision of electronic communications services is simple and transparent. In Serbia, the authorization regime is generally in line with EU requirements; however, the information required by the regulator about the network and services to be provided is more substantial when compared to what is required for the same purpose in neighbouring countries, except for BiH. BiH still applies a license regime that is complex to comply with and not aligned with the current EU regulatory framework for electronic communications. It is advisable that BiH update its license regime accordingly.

Dispute resolution. This part of the analysis reviewed: (i) the status of the implementation of Directive 2014/61/EU across the Western Balkan countries, and (ii) whether any other corresponding regulations are in place to deal with the issue.

Each sector involved in infrastructure sharing traditionally has its own dispute-resolution procedures (electricity and electronic communications sectors, in this case) that are implemented by the sector-specific regulators. Usually those procedures are for participants in the same sector and do not apply to cross-sector disputes (which are common in the case of infrastructure sharing). The lack of dispute-resolution procedures for cross-sector disputes is being addressed through the transposition of Directive 2014/61/EU, which requires countries to assign a relevant body or bodies to be responsible for the resolution of disputes.

The outcomes are as follows:

>> **With the exception of BiH, all Western Balkan countries have completed the transposition or have concrete plans to transpose the relevant provisions of Directive 2014/61/EU. Albania and North Macedonia** have completed the transposition process. **Kosovo, Montenegro, and Serbia** plan to transpose the directive through a number of dedicated legal acts.

>> **Albania** has decided to divide the responsibility for infrastructure-sharing disputes between the energy and electronic communications regulators. The disputes between a TSO and the carriers are the responsibility of an energy regulator, the ERE. **In North Macedonia**, the electronic communications sector regulator (AEK) is responsible for dispute resolution in cases of infrastructure sharing. At the time of this writing, in **Kosovo, Montenegro, and Serbia**, resolution of infrastructure-sharing disputes is the responsibility of the sector regula-

[47] TSOs could offer dark fiber and capacities via the implemented transmission technology. If the competition is not effective and an SMP exists, then a TSO, when entering the market, could offer better conditions than the regulated operator(s) and slowly acquire a market share. It is always better for a TSO if the competition on the trunk segments is not effective and ex ante regulation exists. This means that remedies are imposed on SMP players. In this case, a TSO knows its conditions and could easily acquire new customers. If the relevant market is not effective, it principally means that fewer carriers are offering their services on the relevant market and a new player could easily acquire a higher market share. Furthermore, it is better for a TSO if dark fiber is included in the market, since it is difficult to expect that a TSO will become an SMP player in a reasonable time period and will be regulated. On the other hand, the main competitor is regulated, and this signifies some advantages for a TSO. Proper ex ante regulation could be one of the levers, though other major actions need to be taken to enforce infrastructure sharing in a country.

tors (ARKEP, EKIP, and RATEL). **Kosovo, Montenegro, and Serbia** are still in the process of preparing dedicated laws to establish dispute-resolution procedures and thus the framework for dispute resolution in infrastructure-sharing disputes has not been finalized. **Serbia** is currently preparing a dedicated law to transpose the directive, though the current Law on Electronic Communications includes many of its requirements. In **BiH**, a dedicated approach toward dispute resolution for infrastructure-sharing disputes has not yet been established.

The transposition and implementation of the directive is important, as it provides useful instruments that go beyond dispute resolution and support smoother and more efficient broadband infrastructure development. The transposition of those instruments into the national legal framework is therefore critical. As stated by the EC,[48] "[a]lignment with the Broadband Cost Reduction Directive is ongoing in the Western Balkans, but implementation is uneven and sometimes the lack of coordination between the national level and local municipalities hampers the speed of broadband infrastructure rollout."

PPPs and procurement legislation. This was reviewed to determine: (i) whether procurement legislation excludes electronic communications activity and is in line with EU Directives 2014/23/EU and 2014/25/EU, and (ii) whether there any limitations in the legislation regarding PPPs. As noted above, procurement legislation that does not include electronic communications activity provides flexibility to market players to more easily fulfill market needs. PPPs are very important when a combination of funds from a TSO and a private investor is needed for the further development of the electronic communications infrastructure.

Legislation on PPPS and procurement in the Western Balkan countries is as follows:

- With the **exception of Kosovo**, electronic communications services are excluded from the applicable procurement procedures **in all countries of the Western Balkans** because of the existing competition in the electronic communications market. In **Kosovo**, telecommunications activity is required to use official procurement procedures, which is not in line with Directive 2014/25/EU. It is worth mentioning that, acting on the identified bottleneck in its regulatory regime during the process of writing this study, **Kosovo** has initiated the relevant changes to its current legal framework.

- **No PPP limitations** were found in the legislation of the Western Balkan countries.

In brief, there are no major bottlenecks in the legislation of the Western Balkan countries that would prevent infrastructure sharing from going forward, but some obstacles still need to be removed to improve the overall framework for the process. The situation stems primarily from the variations in the business environment for TSOs in the different countries. The obstacles should be eliminated not only to encourage infrastructure sharing in each country but also to create more transparent and uniform conditions for any operators willing to provide infrastructure-sharing services across the region.

48 EC, "Measures in Support of a Digital Agenda for the Western Balkans" (Brussels: European Commission, 2018), https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/swd_measures_in_support_of_a_digital_agenda_for_the_western_balkans.pdf.

III. RECOMMENDATIONS

Clear and long-term national broadband development strategic goals are a necessity.

At the start of the pre-feasibility works, Montenegro, Albania, Serbia, and Kosovo had developed their Digital Agendas. However, many of those plans already need to be updated, as the time periods they cover will end soon and a re-evaluation of the goals is required. The other countries are still in the process of developing national broadband strategies.[49] The absence of this kind of strategic guidance creates uncertainties for (potential) market players and complicates their planning process. Clearly, in view of the impact of broadband on a country's social and economic development, broadband policy should be at the top of each government's agenda.

The EC adopted the Western Balkans Strategy on February 6, 2018, and one of the six flagship initiatives is the Digital Agenda for the Western Balkans. That agenda was launched on June 25, 2018, and it "aims to support the transition of the region into a digital economy and bring the benefits of the digital transformation, such as faster economic growth, more jobs, and better services."[50] The EC, together with ministers from the six Western Balkan partners—Albania, BiH, Kosovo, Montenegro, North Macedonia, and Serbia—among other actions, committed to improving broadband connectivity by investing and reducing the cost of the infrastructure required and building competencies in broadband development. This could be an excellent reference point for the countries that still lack their own Digital Agendas.

A key task for all the governments is not only setting goals but also reviewing the available instruments needed to achieve them. It is particularly critical to determine ways to foster and simplify infrastructure sharing, as has occurred in many developed countries.[51] Utilities, especially TSOs, may play an important role, as in most countries, their OPGW networks are the second most important networks after the incumbent's. There are also areas where the incumbent has no network or where the network of other infrastructure carriers could be used as a backup route to increase the quality of broadband services. Fostering cross-sectoral infrastructure sharing in the region should thus be of national importance to the Western Balkan countries.

Regulatory and legislative alignment with EU legislation should continue.

Advancements in policy making and the transposition of EU frameworks are still a challenge for some Western Balkan countries. Legislative uncertainties related to infrastructure sharing need to be removed in order to create regulatory certainty for market players, to ease the TSO's entry into the market, and to ensure transparent, equal, and non-discriminatory rules for all. This is essential not only for the competitiveness of national markets but also for regional cooperation.

In view of most Western Balkan countries' ongoing preparations to become EU members, the alignment of their national legislative and regulatory frameworks with the EU directives should continue.

A review of companies' long-term strategic objectives is needed.

With national broadband development objectives and a clear regulatory environment in place, it is essential that companies (TSOs, in this case) review their corporate strategic goals, specifically with regard to how they correspond with national objectives. As TSOs are usually government owned, this alignment becomes even more important. The approval of clear strategic objectives by company shareholders would ease communication with regulators, policy makers, and other stakeholders who can often make a company's decision-making process particularly cumbersome. If, for example, a TSO formulates a strategic goal of becoming the biggest neutral backbone network provider (in order to facilitate national broadband development, accommodate increasing traffic, and so forth) and goes on to create an underlying action plan, the company should not have to go back and forth for regulatory or policy makers' support for every related investment. Instead, a substantial justification should be prepared (that evaluates, for example, the expected benefits, required investments, associated risks, and so on) for a strategic blueprint, which then must be followed by implementation plans.

49 The Digital Agenda for Serbia consists of two documents: the "Strategy for the Development of the Information Society in the Republic of Serbia to 2020" and the "Strategy for the Development of Electronic Communication in the Republic of Serbia from 2010 to 2020." In addition, a "Strategy for the Development of Next Generation Networks (NGN) in the Republic of Serbia to 2023" has been drafted. BiH and North Macedonia have not yet adopted their national Digital Agendas.

50 EC, "Commission Launches Digital Agenda for the Western Balkans," European Commission, June 25, 2018, http://europa.eu/rapid/press-release_IP-18-4242_en.htm.

51 Infrastructure sharing is one of the crucial elements needed to reach the goal of a Digital Single Market for the EU.

Choosing a wholesale-only business model is advisable.

The range and type of services that may be provided by TSOs depend on their disposable finances, the amount of risk they can assume, the characteristics of the local telecom market, and their willingness to capture value in that telecom market. However, as good practice examples demonstrate, the wholesale-only business model is a good place to start, and forecasts show that this business model will continue to have great potential in the future. With clear strategic goals set, it will be much easier for a TSO to take and ground decisions in the **business model chosen.**

The following business opportunities for energy operators in the telecom market exist at the wholesale level:

a) **Physical infrastructure sharing.** TSOs are obligated to offer services under Directive 2014/61/EU. An electricity operator (in this case, a TSO) may share its current physical infrastructure with other carriers, such as poles, ducts, and anything that can hold electronic communications infrastructure. This strategy requires hardly any investment and is therefore the safest strategy of all.

b) **Dark fiber leasing.** A TSO may charge third parties for the use of its dark fiber. Dark fiber leasing involves no extra investment in any active telecom equipment. Since the value of dark fiber is directly proportional to its length, this strategy is used primarily when a TSO has a widely spread electronic communications network. A TSO may develop a special department that deploys fiber cables in particular routes that have been previously requested by carriers. The customers could be national or international carriers, banks, or state institutions, all of which need dark fiber and will deploy their transmission system on it. In this case, a TSO may find it useful to collaborate with a DSO, whose distribution network may be important to reaching every locality[52]. Dark fiber could be leased monthly and on an indefeasible rights of use (IRU) basis (which means prepayment and some percentage for annual maintenance).

c) **Colocation Space.** Together with dark fiber, a TSO can also lease its colocation space for telecommunications operators to install their equipment, for example, amplifiers. Amplification of the signal may be needed in some cases where the length of the leased dark fiber is long. On the other hand, the need for colocation space for amplification equipment can be included in the price of the leased

d) dark fiber, since it represents only a small part of the costs for a TSO. Colocation spaces can be offered to all of the above-mentioned customers, and mobile operators would need more colocation spaces in improving LTE and building the 5G network, which requires that they are closer to their end customers.

e) **Capacity leasing.** A TSO that has invested in active telecom equipment may start leasing capacities, which means the leasing of bandwidths in the network from one point to another. In this case, the last mile connections to end users need to be provided, which indicates that it is very important that distribution companies are included in the agreement. The capacities can be leased to business customers and to domestic and international operators.

Combination of the business opportunities above. One common option is to offer dark fiber services together with colocation services, as was done by the TSO in Kosovo. It should be noted that the provision of dark fiber and colocation may be considered the fastest strategy for TSOs to start infrastructure sharing, as initial investments are relatively low (though organizational issues still have to be solved). However, if not offered from the start, in the medium or long term, it is reasonable to consider a capacity leasing model.

During the course of this work, the various options were discussed with the TSOs. The majority clearly stated their intent to offer capacity leasing rather than dark fiber services at the start. Although this model of service provision would require some initial investments, for example, active equipment to light the fibers, it indeed offers better conditions for service-level agreements (SLAs)[53] that match the high requirements of telecommunications operators.

52 Especially in Serbia the DSO (EPS) owns considerable OPWG assets and thus involvement of the DSO may have greater impact on the market.

53 LAs are used to define the requirements of service quality, for example, how quickly service has to be restored when it has been interrupted. In telecommunications, SLA requirements are very high.

The separation of telecom activities from the TSO's primary activity (in terms of accountability and/or organization) is advisable from the very beginning of the infrastructure-sharing practice.

Telecommunications activity as a non-electricity activity should be separated from the TSO's main activity (electricity transmission) in the accounting process. It is also advisable to create a separate organizational unit for this activity (e.g., in the form of a daughter company or as a separate unit within a TSO). A daughter company or a separate unit, accountable directly to the head of a TSO, ensures more flexibility in operations and provides a stronger incentive for employees, who may be remunerated according to their output. Reactions to changes in the market could be faster because of the clearer organization of the management's decision-making process. The separation would ease accountability and communication with regulators and make it easier to monitor the results. The main weakness of this kind of separation stems from having less control over or impact on the development plans. However, there is no "one size fits all" approach, and the eventual organizational setup in each country will depend on country- or company-specific factors.

Start locally – think globally.

Though national strategies for broadband development usually address and stress the importance of national markets, TSOs as business entities should not forget the opportunities outside of these markets. A proper example might be the Baltic Digital Highway, in which the companies involved receive more than half of their revenues from cross-border contracts. Clearly, reliable physical international links with neighboring countries are necessary for this to happen, though these links actually pose a double-edged benefit for operators. On the one hand, they reduce risks by increasing redundancy; if an international link ever fails, other connections can redistribute the traffic through an alternative link. On the other hand, these links can also leverage the availability of different interconnecting points, thus allowing a TSO to have a more solid position when negotiating its peering and transit costs with other operators, ultimately leading to cost reductions. Thus, it is strongly recommended that Western Balkan TSOs consider international cooperation—starting within the region. Of course, the initial infrastructure-sharing activities are easier to set at a national level, and implementation of infrastructure sharing at the national level is a necessary prerequisite to international cooperation.

Pre-feasibility workshop discussions indicated that potential cross-border partners, such as TSOs in Romania and Greece, are monitoring the situation in the Western Balkans and are interested in collaboration.[54] Even more, participating TSOs have agreed to establish an informal group for infrastructure sharing, to, among others aims, coordinate standards for interconnections and share information about the fiber networks. At the time of this writing, the working group was actively discussing concrete next steps in pursuing the implementation of national infrastructure sharing and regional collaboration.

Human capacity is key to success.

All six TSOs have a separate structural unit (usually a department)[55] dedicated to supporting information technology and telecommunications. The staff in these ICT departments carry out the work needed to support the core activities of the TSOs. Even in cases where TSOs have already begun sharing their free optical infrastructure (KOSTT, CGES), the ICT departments do not have enough staff to fully support the infrastructure services marketing and sales tasks and the implementation procedures. Capacity building may help to overcome this challenge. As a first step, a two-day workshop in Tirana, organized by the World Bank at the invitation of the Government of Albania and the Albanian TSO in September 2018, brought the heads of telecom departments together with the senior leadership of several TSOs. The TSOs were introduced to a number of national-level and cross-border infrastructure-sharing examples from the EU and Latin America.[56]

Major recommendations for each country are summarized in table 8 in **Annex 2**. These recommendations are not meant to be prescriptive but rather to inform internal decision makers of TSOs and their stakeholders in the telecom and energy sectors of the actions needed to successfully proceed with infrastructure sharing.

54 KOSTT, "KOSTT Supports Further Scoping of the Balkans Digital Highway Infrastructure-Sharing Initiative" (Pristina: KOSTT, 2018), www.kostt.com/website/index.php/en/press-releases/1326-2-tetor-2018-kostt-supports-further-scoping-of-the-balkans-digital-highway-infrastructure-sharing-initiative-.htm.

55 Except for EMS, where the optical network is in EPS management.

56 KOSTT, "KOSTT Supports Further Scoping of the Balkans Digital Highway Infrastructure-Sharing Initiative."

CONCLUSIONS

In conclusion, it is worth mentioning that this pre-feasibility work was one of the first attempts to extensively evaluate the infrastructure-sharing situation in the Western Balkans, including its potential benefits and implementation constraints. It not only analyzed the current and potential future demand for such services, but also provided a technical inventory of existing TSO infrastructure in the entire region by mapping the available data (which was not an easy task, as such data had never been collected before and TSOs do not have GIS systems to clearly and promptly provide information on their infrastructure). The regulatory and legal environments were also analyzed in detail to identify the possible obstacles to infrastructure sharing. Additionally, significant intermediary results were achieved, including:

- North Macedonia amended its Law on Energy to permit infrastructure sharing, and its TSO launched infrastructure sharing during the course of writing this study.
- Albania's TSO outlined a plan for the operationalization of infrastructure sharing.
- Kosovo's TSO intensified its infrastructure sharing by commercializing about 10 percent of its fiber optic network. The company also started to plan the modernization of its telecommunications network to enable regional infrastructure sharing.
- BiH's energy regulator agreed to reconsider its previously unfavorable decision regarding potential infrastructure sharing whenever the TSO requests it.
- All the TSOs in the Western Balkans have confirmed their intention—or are taking the relevant actions—to provide infrastructure-sharing services.
- The prime ministers of all six countries committed to a regional infrastructure-sharing initiative as part of the Multi-Annual Action Plan on the Regional Economic Area.
- The Western Balkan TSOs have formed a group to discuss regional infrastructure sharing.
- North Macedonia, Kosovo, and Albania have started discussions on a potential joint application to the Western Balkans Investment Framework (WBIF) to request funds for feasibility studies on the next phase of activities in order to build upon this pre-feasibility work (starting in 2019/2020).

There is still a substantial amount of work to do for all stakeholders, including policy makers, regulators, and TSOs, but the results of the pre-feasibility work and the dialogue it generated indicate that infrastructure sharing is set to accelerate in the Western Balkans. The Balkan Digital Highway may soon become another example on the global list of successful cases of cross-country electricity-telecommunications infrastructure sharing.

ANNEXES

ANNEX 1. List of Stakeholders

>> Telecom regulators:

- The Electronic and Postal Communications Authority (AKEP) in Albaniaw
- Communications Regulatory Agency (CRA, RAK) in BiH
- Agency for Electronic Communications (AEC, AEK) in Republic of North Macedonia
- Regulatory Authority of Electronic and Postal Communications (RAEPC, ARKEP) in Kosovo
- Agency for Electronic Communications and Postal Services (AECP, EKIP) in Montenegro
- Republic Agency for Electronic Communications and Postal Services (RATEL) in Serbia

>> Line ministries responsible for telecommunications:

- Ministry of Energy and Infrastructure (MIE) in Albania
- Ministry of Communications and Transport (MKT) in BiH
- Ministry of Information Society and Administration (MISA) in Republic of North Macedonia
- Ministry of Economic Development (MZHE, MED) in Kosovo
- Ministry of Economy (MEK) in Montenegro
- Ministry of Trade, Tourism and Telecommunications (MTTT) in Serbia

>> Carriers:

- ALBtelecom, Vodafone Albania, Telekom Albania, Albanian Telecommunications Union (ATU), in Albania
- BH Telecom, HT Eronet, Telekom Srpske (m:tel), and Telemach in BiH
- Makedonski Telekom, vip.ONE, and Neotel in Republic of North Macedonia
- IPKO, PTK (Vala), Kujtesa, and Artmotion in Kosovo
- Crnogorski Telekom, Telenor Crne Gore, and m:tel Crne Gore in Montenegro
- Telekom Srbije (MTS), Telenor Serbia, Serbia Broadband (SBB), ORION Telekom, and VIP mobile in Serbia

>> International carriers

>> Energy regulators:

- Energy Regulatory Agency (ERE) in Albania
- State Electricity Regulatory Commission (SERC, DERK) in BiH
- Regulatory Commission for Energy in Federation of Bosnia and Herzegovina (FERK) in BiH
- Energy Regulatory Commission (ERC) in Republic of North Macedonia
- Energy Regulatory Office (ERO) in Kosovo
- Montenegro Energy Regulatory Agency (REGAGEN) in Montenegro
- Energy Agency of the Republic of Serbia (AERS) in Serbia

>> Ministries responsible for energy:

- Ministry of Energy and Industry (MIE) in Albania
- Federal Ministry of Energy, Mining, and Industry (FMERI) in BiH
- Ministry of Economy (ECONOMY) in Republic of North Macedonia,
- Ministry of Economic Development (MZHE, MED) in Kosovo,
- Ministry of Economy (MEK) in Montenegro and
- Ministry of Mining and Energy (MRE) in Serbia.

>> Transmission system operators:

- OST in Albania
- ELEKTROPRENOS in BiH
- MEPSO in Republic of North Macedonia
- KOSTT in Kosovo
- CGES in Montenegro
- EMS in Serbia

ANNEX 2. List of Recommendations by Country

Table 8 List of Recommendations by Country

	Technical	Regulatory	Organizational	Strategic
Albania	✓ Pricing strategy ✓ Sales contact (IRU/non-IRU) ✓ Standard terms and conditions ✓ GIS and Asset Management System ✓ Close the national OPGW network gaps ✓ OST should implement IP/MPLS ✓ OST should close the international OPGW network gap with North Macedonia ✓ ELEKTROPRENOS/ ELEKTROPRENOS should implement DWDM and upgrade IP/MPLS	✓ Opinion from ERE, notification to AKEP ✓ ERE needs to decide how to treat the unregulated revenues	✓ Set-up of internal processes to support telecommunication activities ✓ Billing ✓ Separate accounting model and process ✓ Flexible procurement process ✓ Project manager-new employee ✓ Market research and business plan ✓ Market activities plan ✓ New customer implementation process plan ✓ Access to the sites (security process-part of general terms and conditions)	
Bosnia and Herzegovina		✓ Approval from SERC ✓ RAK needs to issue the license ✓ Transposition of Directive 2014/61/EU into the legislation ✓ Permissions, e.g., for an international connection via cable, should be reconsidered ✓ Major update of the regulatory framework for electronic communications is required		✓ Due to TSO's ownership structure, it is important to secure strategic (political) support for infrastructure sharing
Kosovo	✓ Implementation of IP/MPLS ✓ Implementation of DWDM ✓ GIS and asset management system ✓ Close the national OPGW network gaps	✓ ARKEP should repeat an analysis of the relevant market for wholesale provisioning of trunk segments of leased lines ✓ Implementation of Directive 2014/61/EU in the legislation ✓ The Law on Procurement must be amended and harmonized with EU Directive 2014/25/EU	✓ Billing ✓ Separate accounting model and process ✓ Project manager-new employee	
North Macedonia	✓ Pricing strategy ✓ Sales contact (IRU/non-IRU) ✓ Standard terms and conditions ✓ Implementation of DWDM and IP/MPLS already in plan ✓ GIS and asset management system ✓ Close the national OPGW network gaps and an international OPGW network gap with Albania		✓ Internal processes to support telecommunication activities ✓ Billing ✓ Separate accounting model and process ✓ Flexible procurement process ✓ Project manager-new employee ✓ Market research and business plan ✓ Market activities plan	

	Technical	Regulatory	Organizational	Strategic
Montenegro	✓ CGES should reconsider pricing strategy (IRU model of leasing may be considered) ✓ CGES should calculate its costs for optical fiber leasing and consider a capacity leasing option ✓ Close the national OPGW network gaps	✓ Adjust secondary legislation to allow building the optical fibers on 10 KW ✓ REGAGEN should redonsider its current decision on the treatment of non-regulated revenue and; consider leaving the revenues in full to CGES	✓ New customer implementation process plan ✓ Access to the sites (security process-part of general terms and conditions)	
Serbia	✓ Pricing strategy (model, LRIC calculation) ✓ Sales contact (IRU, non-IRU) ✓ Standard terms and conditions ✓ Implementation of IP/MPLS ✓ DWDM already in plan ✓ GIS and asset management system ✓ Close the national OPGW network gaps	✓ The treatment of unregulated income needs to be prescribed ✓ Complete trasposition of Directive 2014/61/EU into the legislation		✓ Define the owner of the asset (EMS or EPS)

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