WORLD BANK GROUP

INFRASTRUCTURE IN ASIA AND THE PACIFIC

Road Transport, Electricity, and Water & Sanitation Services in East Asia, South Asia & the Pacific Islands

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Introduction and Overview

Infrastructure assets and services provide the basic physical and organizational structures that underpin the functioning of economy and society. Access to reliable, quality, efficient, and affordable infrastructure services is critical to reducing poverty, promoting economic growth, supporting social development, and building resilient communities.

Much of the global population lacks access to basic physical infrastructure, including roads, piped water supply, improved sanitation, and electricity. Moreover, services may be unreliable, of poor quality, inefficiently supplied, or unaffordable. These conditions impose constraints on human health, quality of life, education, and employment, particularly in rural areas of the global south.

Extending provision of quality infrastructure requires an understanding of the current levels of supply, quality, and affordability of infrastructure services. A first step towards this is to take stock of available data on service coverage, quality, and tariff and cost levels. Such information can help governments and their development partners establish key needs, target resources for strategic priorities, and benchmark infrastructure performance. This exercise is merely the starting point on a greater path of enquiry to understand the overall state of infrastructure services. Although the more definitive analyses of the root causes and nuances of infrastructure delivery are sure to follow, the value of this study is in compiling disparate information, otherwise time-intensive to gather and compare across sectors and countries, into a single volume.

This report provides an overview of infrastructure provision in three key economic sectors—road transport, electricity, and water and sanitation—as an initial step towards building a more extensive body of knowledge on the health of infrastructure provision worldwide. Geographically, this report focuses on two of the world's fastest growing regions, East Asia and Pacific (EAP) and South Asia (SAR), which also account for approximately 35.8 percent of the world's extreme poor. This geographic focus is motivated by recognition of significant infrastructure development needs, particularly in South Asia, coupled with the availability of fairly extensive data across countries.

INFRASTRUCTURE IN ASIA AND THE PACIFIC

Over the past few decades, the East Asia and Pacific and South Asia regions have enjoyed strong economic growth and steady social development. East Asia has experienced steady growth levels of 4.1 to 4.5 percent over the past five years, led primarily by China and ASEAN countries,[1] and regional poverty has been significantly reduced.[2] South Asia has become the fastest-growing economic region worldwide, with its constituent countries recording average annual growth rates of 6.1 to 7.6 percent during the period from 2011 to 2017, led largely by India.[3]

Nevertheless, governments in both regions face significant constraints, imposed by the insufficiency of infrastructure to support development goals. Substantial investments,[4] targeted policy reforms, and improvements to planning, management, and operations are needed to overcome significant infrastructure-service shortfalls and problems associated with both quality and efficiency.

ACCESS, QUALITY, AND AFFORDABILITY

When it comes to infrastructure promoting economic and social development, quality is as important as coverage. Worldwide, governments and their development partners increasingly recognize the importance of efficiency and resilience of infrastructure delivery systems and quality of service outputs. Infrastructure should be safe; resilient with respect to natural disasters and the effects of climate change; and of sufficient structural integrity to remain cost-efficient over the lifecycle of the asset.

This report goes beyond appraising coverage levels of infrastructure services in Asia, by also providing a selection of indicators that serve as proxies of multiple dimensions of infrastructure quality. To inform national, regional, and multilateral efforts to close infrastructure gaps and improve quality of services, this report reviews the status of infrastructure in the road-transport, electricity, and water-and-sanitation sectors across countries in EAP and SAR. From a policy perspective, key questions include: Who receives infrastructure services, and at what level of reliability, quality and affordability? Additionally, how efficiently are these services delivered?

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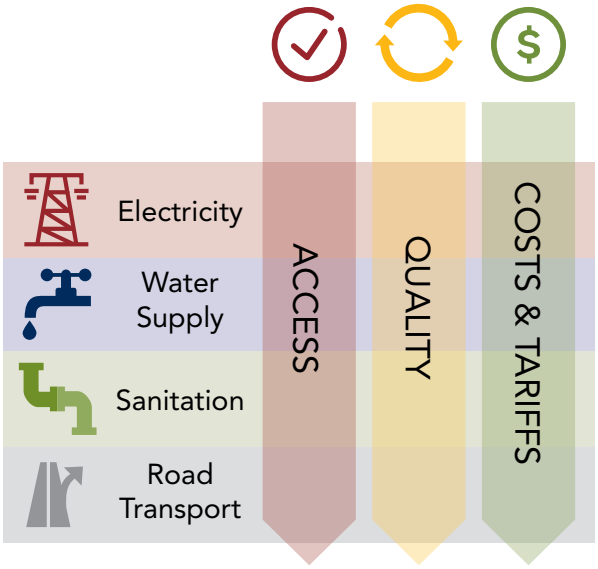
1 Declining from 7.3 percent in 2013, growth in developing EAP has remained strong. Lower growth rates of 6.5 and 6.3 percent in 2017 and 2018, respectively, are attributed to a slowing of China's economic expansion. Aggregate growth in Association of South East Asian Nations (ASEAN) countries remained steady at about 5.3 percent throughout 2017 and 2018. Growth in the Pacific Islands lagged at 2.1 to 3.9 percent from 2011 to 2018, owing largely to constraints imposed by narrow markets, geographic dispersion, and vulnerability to natural disasters.

2 World Bank. 2018. *East Asia Pacific Economic Update*, October 2018: Navigating Uncertainty. http://www.worldbank.org/en/region/eap/publication/east-asia-pacific-economic-update.

3 World Bank. 2018. *South Asia Overview*. Extreme poverty is below 2 percent in EAP, including China (4.4 percent if excluding China), and the lower-middle-income class (LMIC) poverty rates are expected to fall from 9.4 percent in 2017 to 6.4 percent in 2020. https://www.worldbank.org/en/region/sar/overview.

4 Although single-number estimates for required investments are likely to be neither helpful nor correct, particularly because they often fail to consider specific policy objectives or potential efficiency and technological gains (see: Rozenberg, et al. 2019. *Beyond the Gap – How Countries Can Afford the Infrastructure They Need while Protecting the Planet*. World Bank. https://www.worldbank.org/en/topic/publicprivatepartnerships/publication/beyond-the-gap---how-countries-can-afford-the-infrastructure-they-need-while-protecting-the-planet), it has been estimated that EAP (excluding China) requires an additional $52 billion for infrastructure between 2015 and 2020 to keep pace with current growth levels (see: Ruiz-Nuñez, Fernanda, and Zichao Wei. 2015. "Infrastructure investment demands in emerging markets and developing economies." World Bank Policy Research Working Paper, 7414. Washington, DC: The World Bank). Similarly, South Asia may require investments of US$1.7 to 2.5 trillion to meet its needs (see: Biller, Andres, and Herrera Dappe. 2014. *Infrastructure Gap in South Asia: Inequality of Access to Infrastructure Services.* https://openknowledge.worldbank.org/handle/10986/20344). The Asian Development Bank (ADB) estimates that developing Asia needs to invest US$1.7 trillion per year in infrastructure until 2030 to meet its economic-growth and sustainable-development goals (see: Asian Development Bank. 2017. *Meeting Asia's Infrastructure Needs*. Manila, Philippines: Asian Development Bank. doi: 10.22617/FLS168388-2).

REPORT APPROACH AND ORGANIZATION



The report is organized with a framework that examines three dimensions of service provision—access, quality, and cost—across three key economic infrastructure sectors: electricity; water and sanitation; and road transport. This report tracks these three infrastructure dimensions and sectors across most of the countries of EAP and SAR.

The report presents several indicators to describe national-level performance along each dimension. When data is available, these indicators are further subdivided to examine differences in rural and urban service provision, particularly with respect to access. Also, because each dimension under consideration (particularly quality) involves multiple aspects, several indicators are included. The selection of indicators was based on consultations with sector and regional experts, and the use of the most extensive and comparable data available across countries.

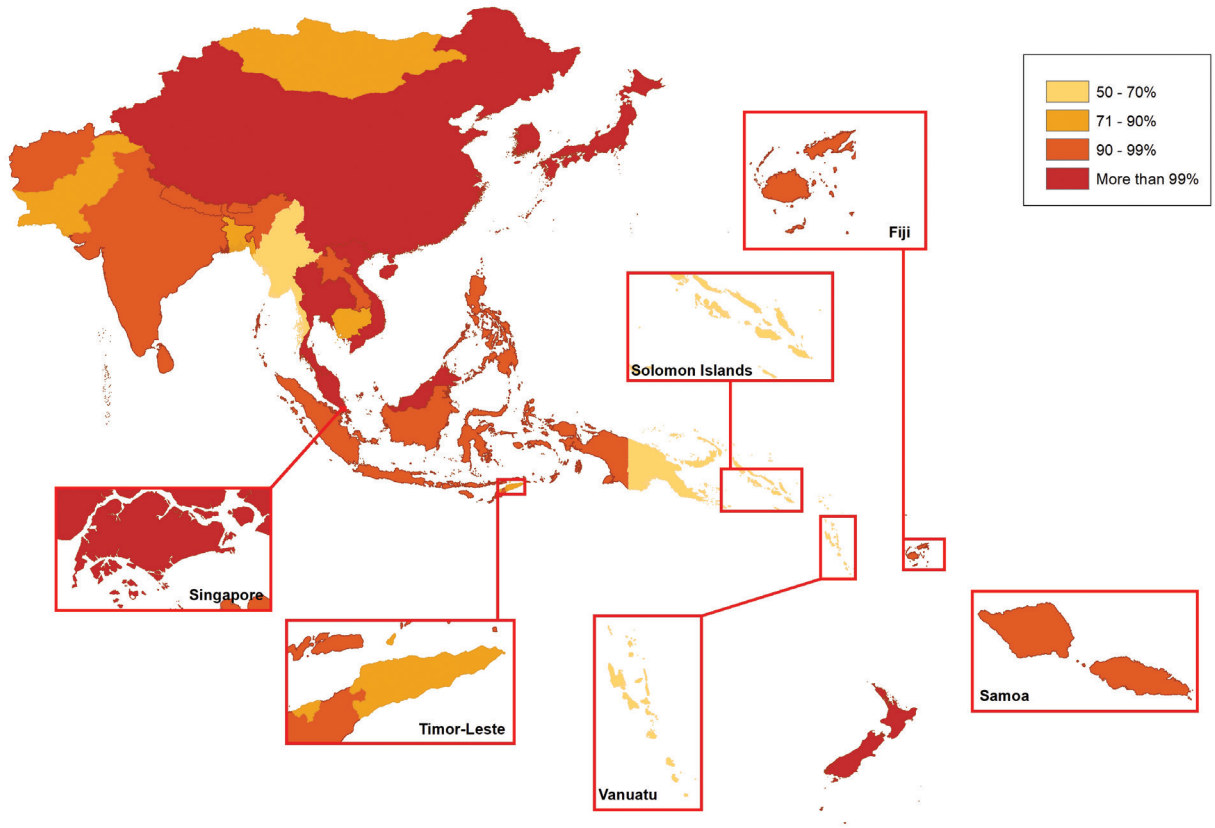
The study compiles data about these sectors for countries across EAP and SAR, including five regional high-income benchmark countries (Brunei Darussalam, Japan, New Zealand, Singapore, and the Republic of Korea). Other countries are categorized into three categories: East Asia, South Asia, and the Pacific Islands. All of the graphics in the report use a standardized color scheme for the four sub-regional categories, as follows:

HIGH-INCOME EAP	EAST ASIA	SOUTH ASIA	PACIFIC ISLANDS
Brunei Darussalam	Cambodia	Afghanistan	Fiji
Japan	China	Bangladesh	Papua New Guinea
New Zealand	Indonesia	Bhutan	Samoa
Singapore	Lao People's Democratic Republic	India	Solomon Islands
Korea	Malaysia	Maldives	Vanuatu
	Mongolia	Nepal	
	Myanmar	Pakistan	
	Philippines	Sri Lanka	
	Thailand		
	Timor-Leste		
	Vietnam		

INFRASTRUCTURE SECTORS IN REVIEW

ELECTRICITY SECTOR REGIONAL REVIEW

Access to Electricity (% of Population)



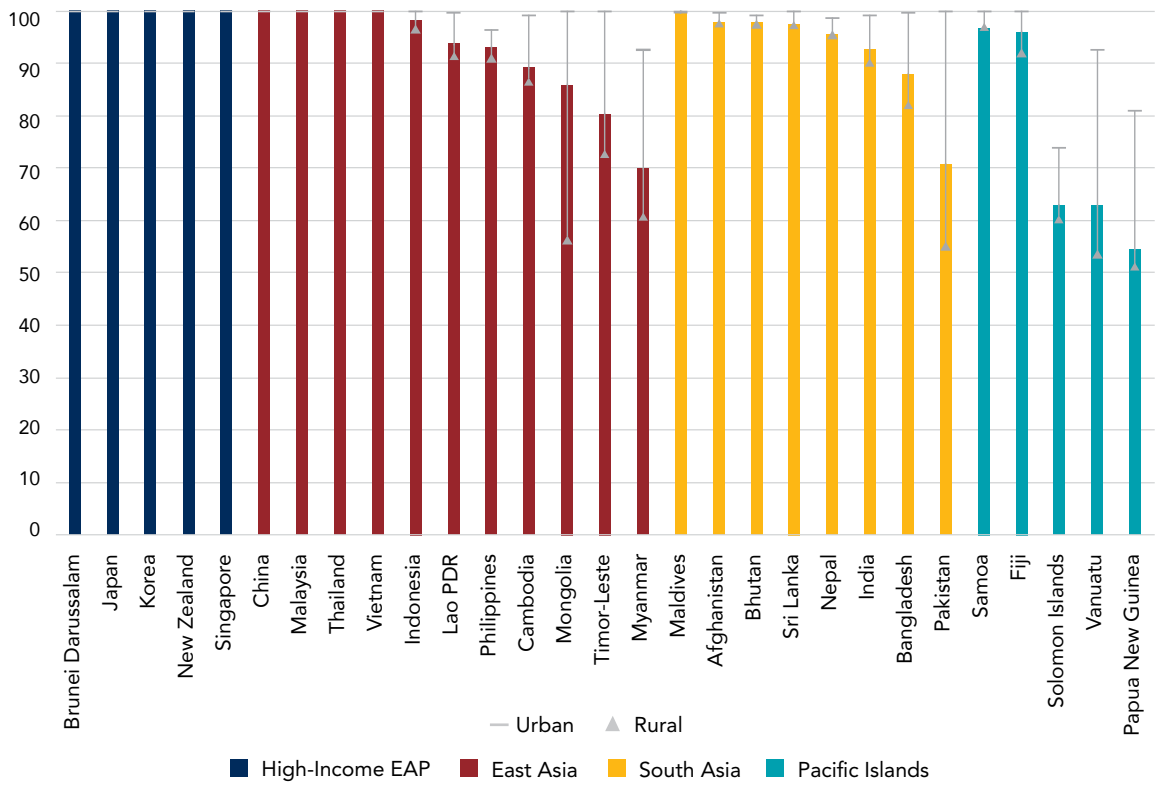
Source: Sustainable Energy for All (SE4ALL) database, 2020 (using 2017 data)

Emerging East Asia has a fairly high regional average access level of 92.5 percent.

East Asia's lowest access-level country — Myanmar (69.8 percent) — is limited by underdeveloped distribution and transmission networks, particularly in rural areas.

Mongolia (55.7 percent), Myanmar (59.9%), and Timor-Leste (71.9%) exhibit low rural access levels, though urban rates are high. Cambodia has extended access significantly in recent years, bringing total access to 89.1% in 2017 from 56.1% in 2015.

Access to Electricity (% of Population)



Source: Sustainable Energy for All (SE4ALL) database, 2020 (using 2017 data)

South Asia's average electricity access is fairly high (92.5 percent), and even rural-coverage levels average 88.8 percent.

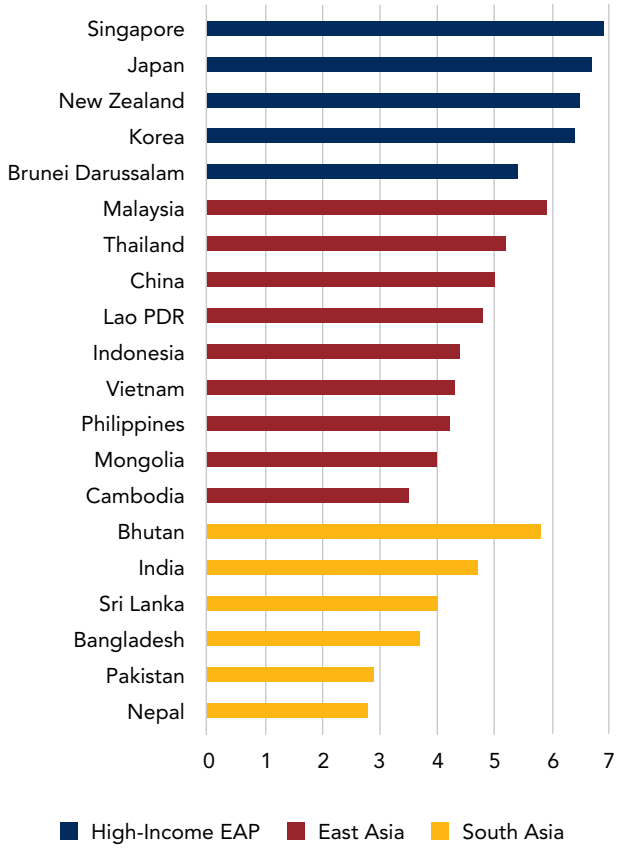
Electricity coverage amongst Pacific-Island states varies significantly. Although Samoa and Fiji enjoy coverage rates over 95%, the remaining Pacific-Island states exhibit a low average coverage level (60.0 percent). Papua New Guinea—the lowest regional performer—has only 54.4 percent electricity-service coverage, largely due to extremely limited rural services (50.4 percent).

Quality of Electricity Supply (1-7, From Best to Worst)

Survey data from the *Global Competitiveness Report* asks respondents to score perceptions of electricity service from 1 (worst) to 7 (best). High-income benchmark countries rank highest, with an average assessment of 6.38, and the average quality score in emerging East Asia (4.59) is higher than that of South Asia (3.98).

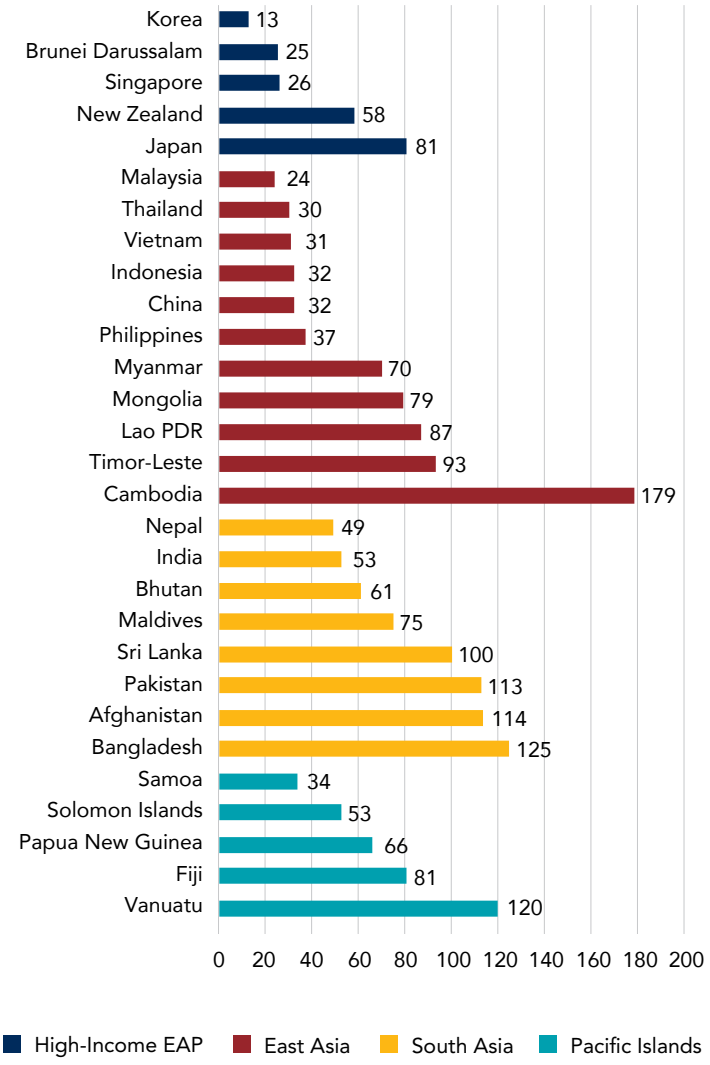
South Asia's average score is skewed negatively by Nepal and Pakistan, the only countries (for which data is available) scoring less than 3. Although Nepal has a record of low perceptions of electricity-service quality, recent improvements made by the Nepal Electricity Authority since 2016 have brought 24-hour electricity services to Kathmandu and Pokhara. Pakistan still has frequent lengthy outages.

Although year-over-year changes from 2016 were minimal, China recorded the largest improvement, with a 0.3 score increase. Survey data is not available for the Pacific Islands.



Source: World Economic Forum, Global Competitiveness Report, 2018; data unavailable for Myanmar, Afghanistan, the Maldives, Timor-Leste and the Pacific Islands.

Average Time for Businesses to Connect Electricity Services (Number of Days)



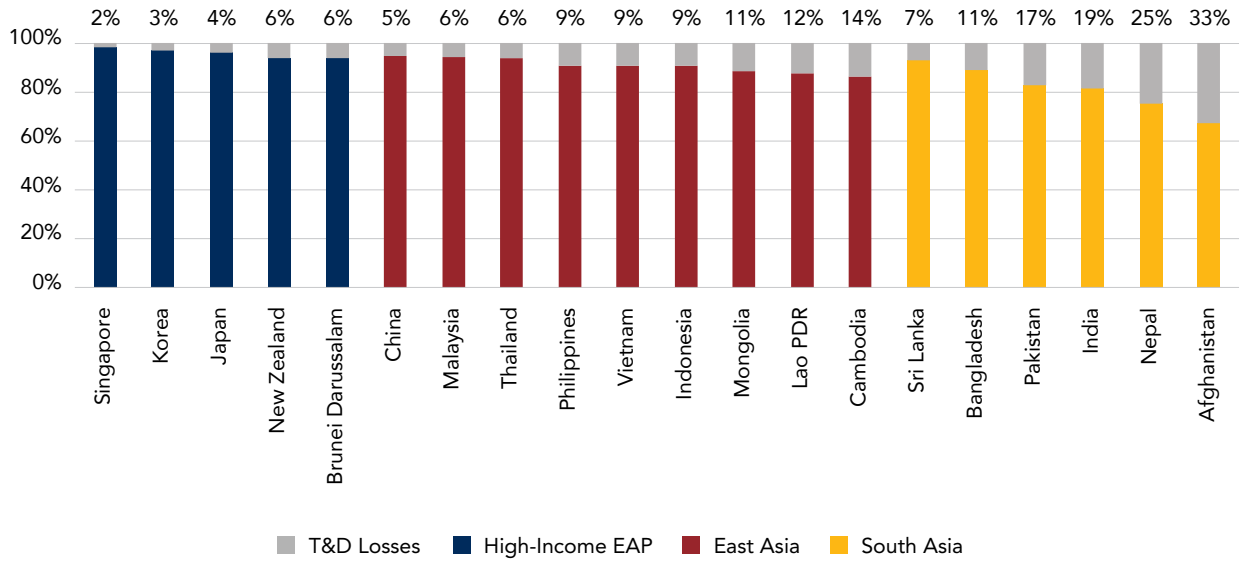
Source: World Bank, Doing Business, 2017.

The World Bank's *Doing Business* report records the average number of days required to connect a newly constructed warehouse to permanent electricity services.

Interestingly, income levels are uncorrelated with the average connection durations, and variance is high in the region, even amongst high-income benchmark countries. The countries with short connection times include high-income states such as Korea, Singapore, and Brunei Darussalam, but also middle-income countries such as Thailand and Malaysia, and lower-income emerging markets such as Samoa, the Philippines, and Indonesia. Thus, sub-regional comparisons are of limited use.

Cambodia, Afghanistan, Bangladesh, Pakistan, Sri Lanka, and Vanuatu stand out for extended connection times of between 100 to 180 days, largely due to complicated and inefficient administration processes.

Transmission and Distribution (T&D) Losses



Sources: All countries, except Afghanistan and Lao PDR: IEA Statistics, 2018 (using 2014 data); World Bank estimate for Afghanistan based on Da Afghanistan Breshna Sherkat data, 2020; Lao PDR source: EDL Statistic Report, 2018.

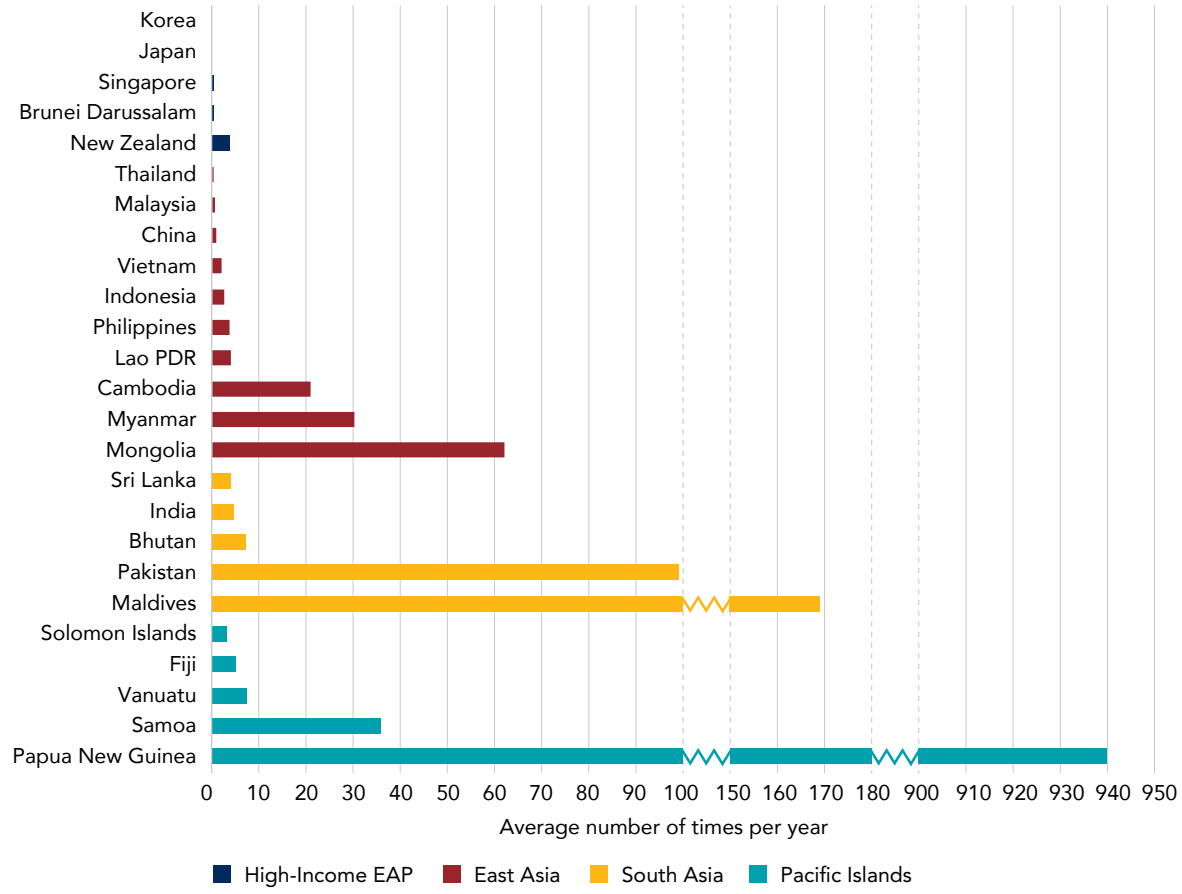
Notes: Electric power transmission and distribution losses include losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage. Data is unavailable for Myanmar, Bhutan, and Pacific Islands.

Electrical-power transmission and distribution losses include losses between supply sources and distribution points in the distribution to consumers, including due to pilferage. These losses are reflective of the technical quality of the network and the efficiency of the distribution system. Data is self-reported by countries to the International Energy Agency.

High-income regional benchmark countries generally have fewer losses (averaging 4.4 percent), though some emerging markets, including China, Malaysia, Thailand, and Sri Lanka, perform around the same levels. Emerging East Asia (the countries for which data is available) generally performs better than South Asia, experiencing losses of 8.7 percent, compared to 15.7 percent. Within East Asia, Cambodia records the highest losses (13.7 percent).

Afghanistan (33.0 percent) and Nepal (25.0 percent) have the most significant transmission and distribution losses amongst countries for which data is available. While Nepal has recorded steady improvements, its high losses are largely attributable to limited financing, a lack of sufficient planning, and difficulties associated with land acquisition.

System Average Interruption Duration (Average Hours per Customer per Year)



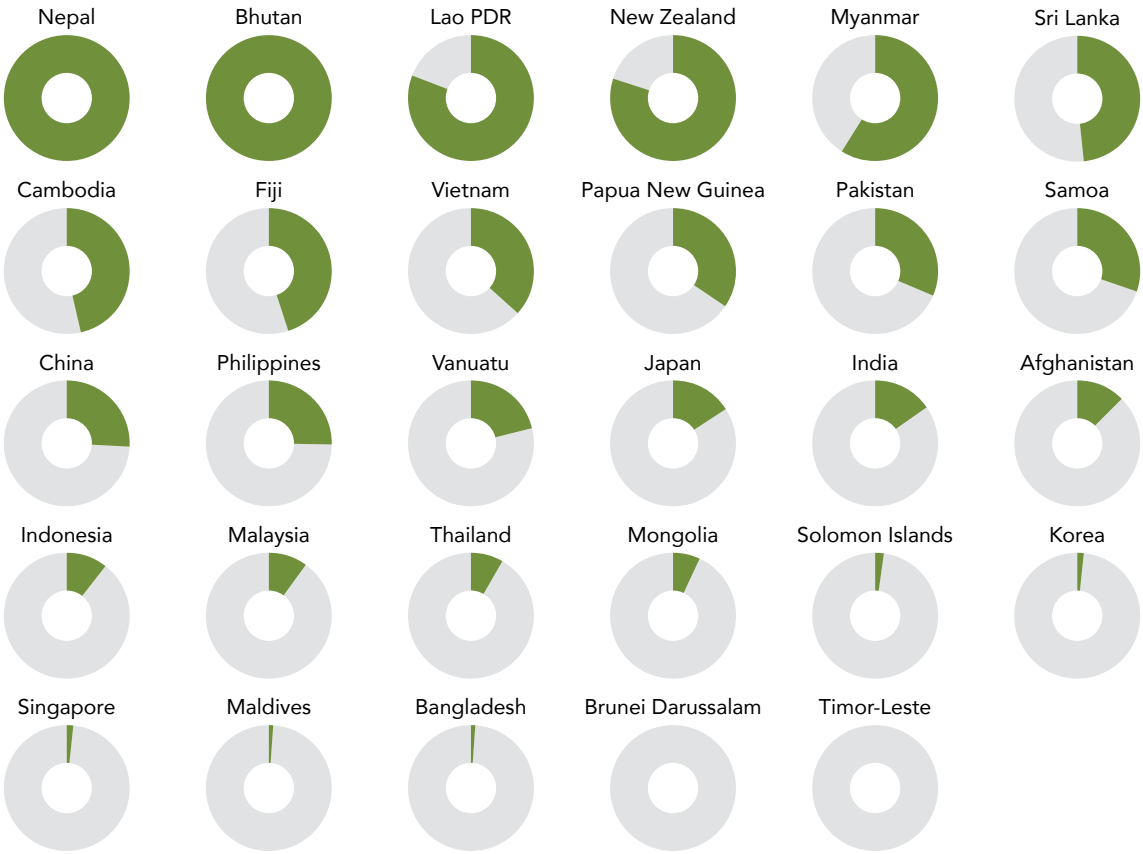
Source: World Bank, Doing Business, 2019.

Note: System Average Interruption Duration is the average total duration of outages over the course of a year for each customer served. Figures are national, except for city-level data for China (Beijing), India (Delhi), Indonesia (Jakarta), Japan (Tokyo), and Pakistan (Karachi). Data is unavailable for Afghanbistan, Bangladesh, Nepal, and Timor-Leste.

High-income regional benchmark countries exhibit low service interruption frequencies and low overall durations of interruption. Amongst emerging markets in the region, low overall interruption durations are recorded for China, Indonesia, Malaysia, Thailand, and Vietnam, all of whom average less than three cumulative hours of interruption per customer each year.

Mongolia, Pakistan, Maldies, and Papua New Guinea all recorded high per-customer service interruption disruptions. Papua New Guinea's extremely high outage durations are associated with high frequencies of disruption, due largely to insufficient maintenance of plants and transmission lines.Pakistan suffers from outdated facilities and a complex distribution system vulnerable to damages.

Share of Electricity Generated by Renewable Sources (%)

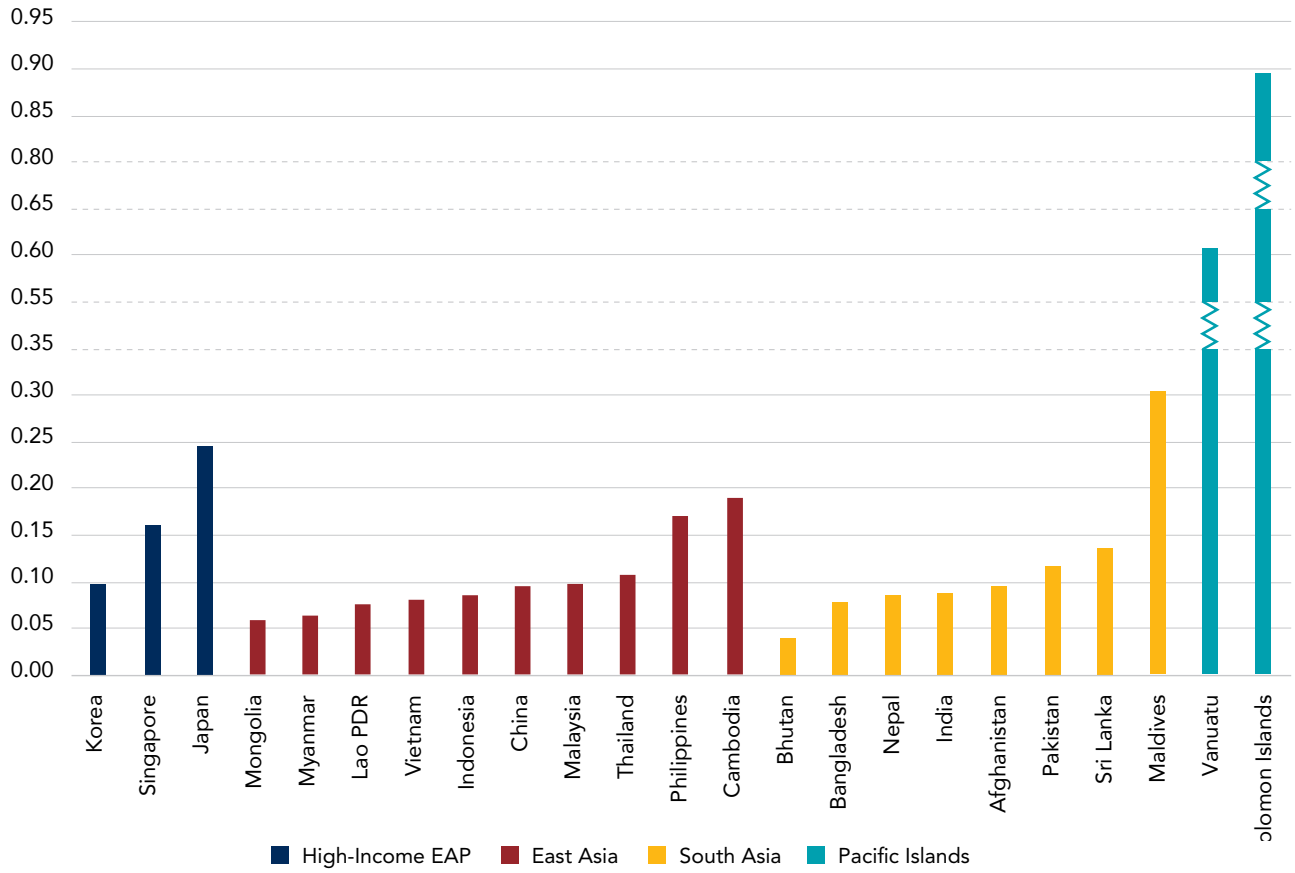


Source: All countries except Afghanistan, China, Lao PDR, and Mongolia: OECD/IEA, IEA Statistics, 2018 (using 2015 data); Afghanistan source: World Bank estimate, based on Da Afghanistan Breshna Sherkat data, 2020; China source: China Power Industry Statistics Express, 2019; Lao PDR source: Calculated by World Bank Energy Team based on the MEM consolidated power development projects, 2020; Mongolia source: World Bank Energy team estimate, 2019.

The share of electricity generated via renewables varies widely in the region, reflecting significant differences in both resource availability and policy. Income levels are not, however, a significant predictor of renewables dependence. Nepal's and Bhutan's vast hydropower resources, for example, afford the countries near-total reliance on renewables for generation; the next-highest performers, New Zealand and Lao PDR, are 20 percentage points lower. In contrast, Bangladesh, Brunei, Korea, Maldives, Mongolia, Singapore, Solomon Islands, and Timor-Leste heavily depend on non-renewables for generation. In countries where electricity demand is rapidly increasing, governments often find it challenging to introduce renewable energy while overcoming insufficient energy supply.

Data reflects domestic generation; countries may consume more imported electricity generated by non-renewables.

Average Electricity Tariff (US$/KWh)



Sources: RISE database, various years, except Bhutan, and Singapore, see Appendix 4.

Notes: Average electricity tariff for all users (US$/KWh) based on $ revenue / total KWh consumed; Data unavailable for Brunei Darussalam, New Zealand, Fiji, Papua New Guinea, Samoa, and Timor-Leste.

On average, countries in East and South Asia have generally low retail electricity tariffs, coupled with high electricity-access rates, except for the Maldives.

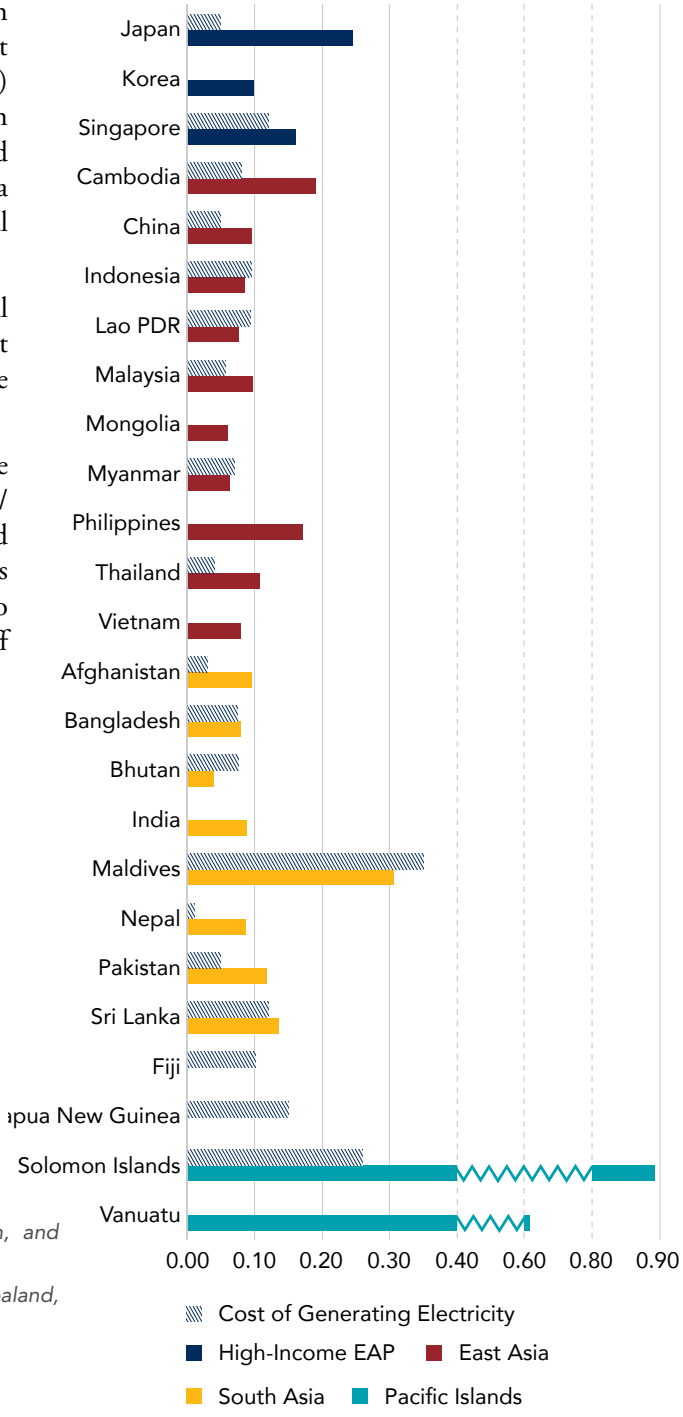
Although data is unavailable for most of the Pacific Islands, the region does generally record higher tariff rates due to geography, under-developed distribution and transmission systems, and high costs of construction and maintenance. Of the countries for which data is available, the Solomon Islands records the highest tariff rate.

Average Electricity Tariff versus Average Operational Cost of Electricity Generation (US$/KWh)

In comparing average retail electricity tariffs with the operational costs of supplying electricity, most countries in the region (for which data is available) cover per-unit (per kWh) operational costs with per-unit tariffs. Bhutan, Indonesia, Lao PDR, and Myanmar are exceptions, with Bhutan charging a subsidized tariff rate significantly below operational costs.

East Asian countries have lower average operational costs for supply than countries in South Asia. Most countries use a varied electricity mix, with active investments in renewables.

South Asia's higher average operational costs are largely attributable to the Maldives (US$0.30-40/kWh), where high dependency on oil has increased the costs of supply. Nepal, on the other hand, has one of the lowest operational cost levels, due to reliance on hydropower. Its comparably high tariff levels are associated with energy-import tariffs.

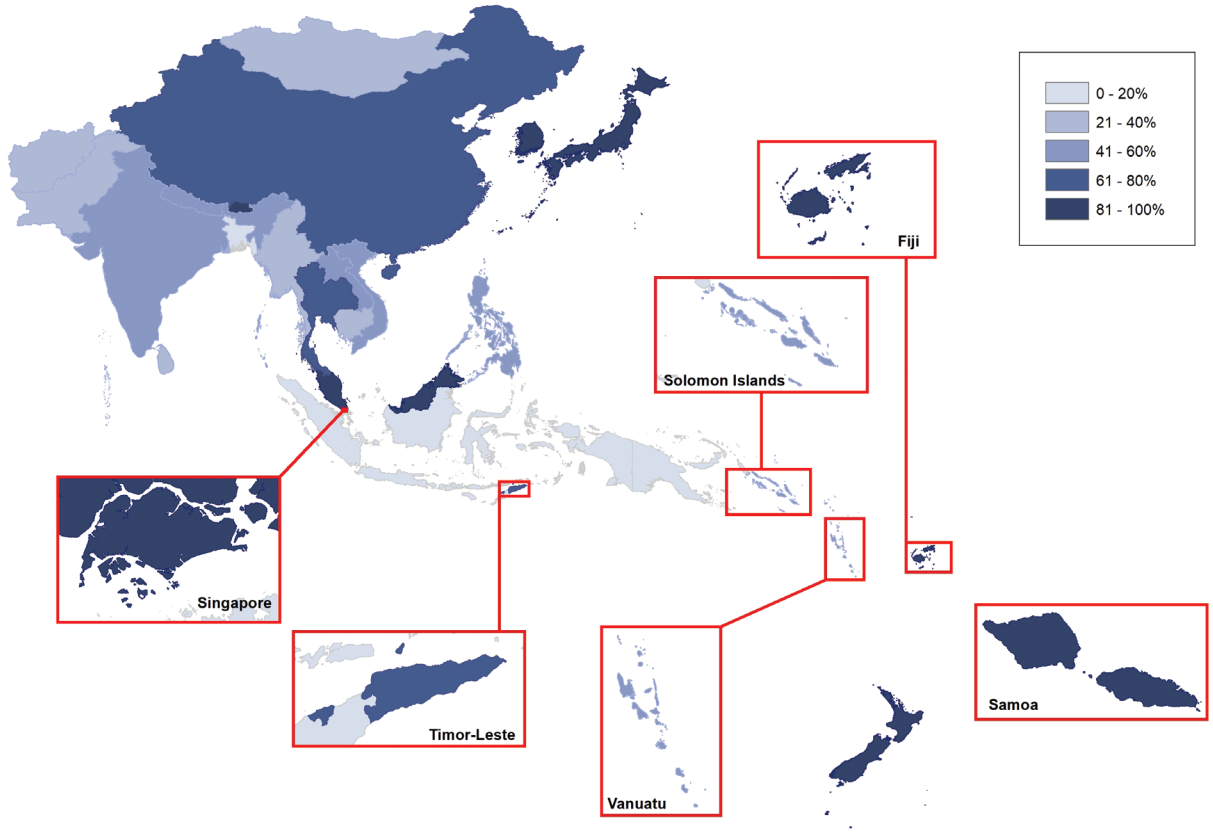


Sources: RISE database, various years, except Bhutan, and Singapore, see Appendix 4.

Notes: Data unavailable for Brunei Darussalam, New Zealand, Fiji, Papua New Guinea, Samoa, and Timor-Leste.

WATER & SANITATION REGIONAL REVIEW

Access to Piped Water (% of Population)

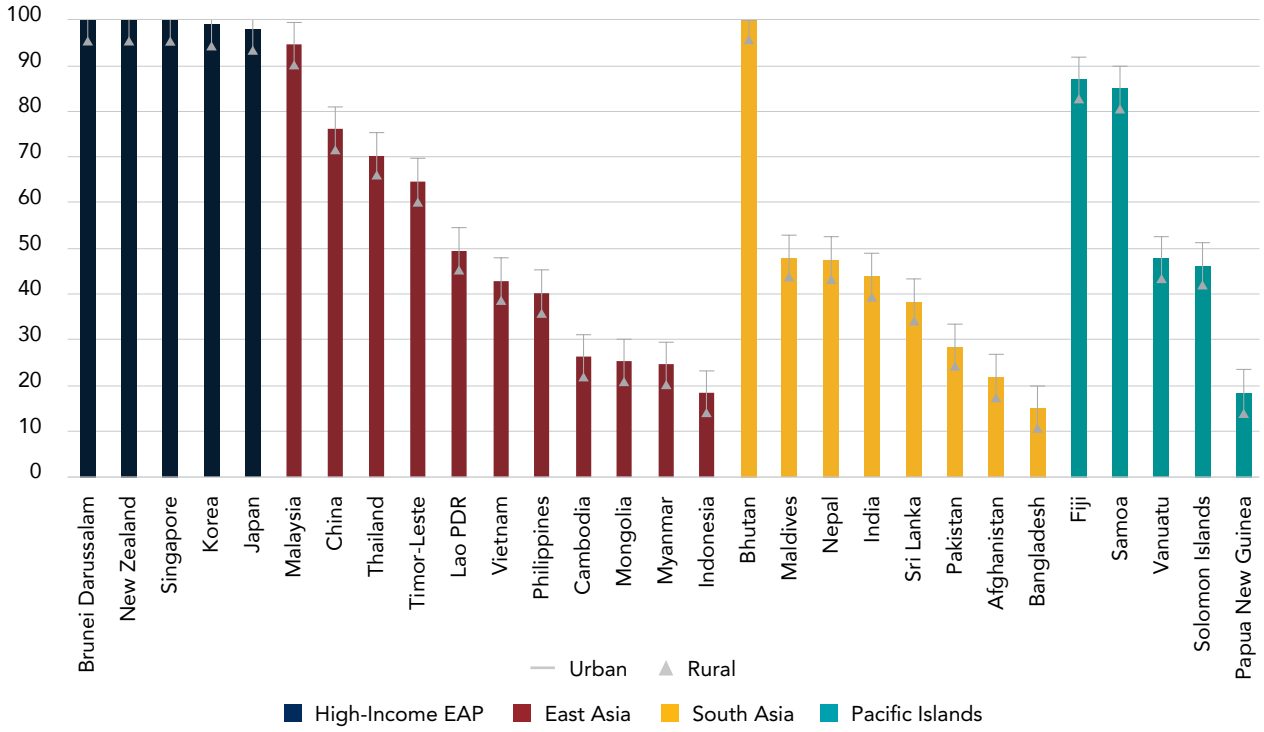


Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data).

In this report, water access refers to household piped connections to services. Although broader definitions are more relevant to progress towards the Sustainable Development Goals (SDGs),[5] this report focuses on large-scale, centralized water systems typical of government provision, particularly in densely populated areas. As such, the access measure does not consider non-networked systems such as protected bores, wells, or rainwater systems.

5 See, for example, SDG 6.1, which measures access to safely managed drinking water services, http://datatopics.worldbank.org/sdgs/

Access to Piped Water (% of Population)



Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data).

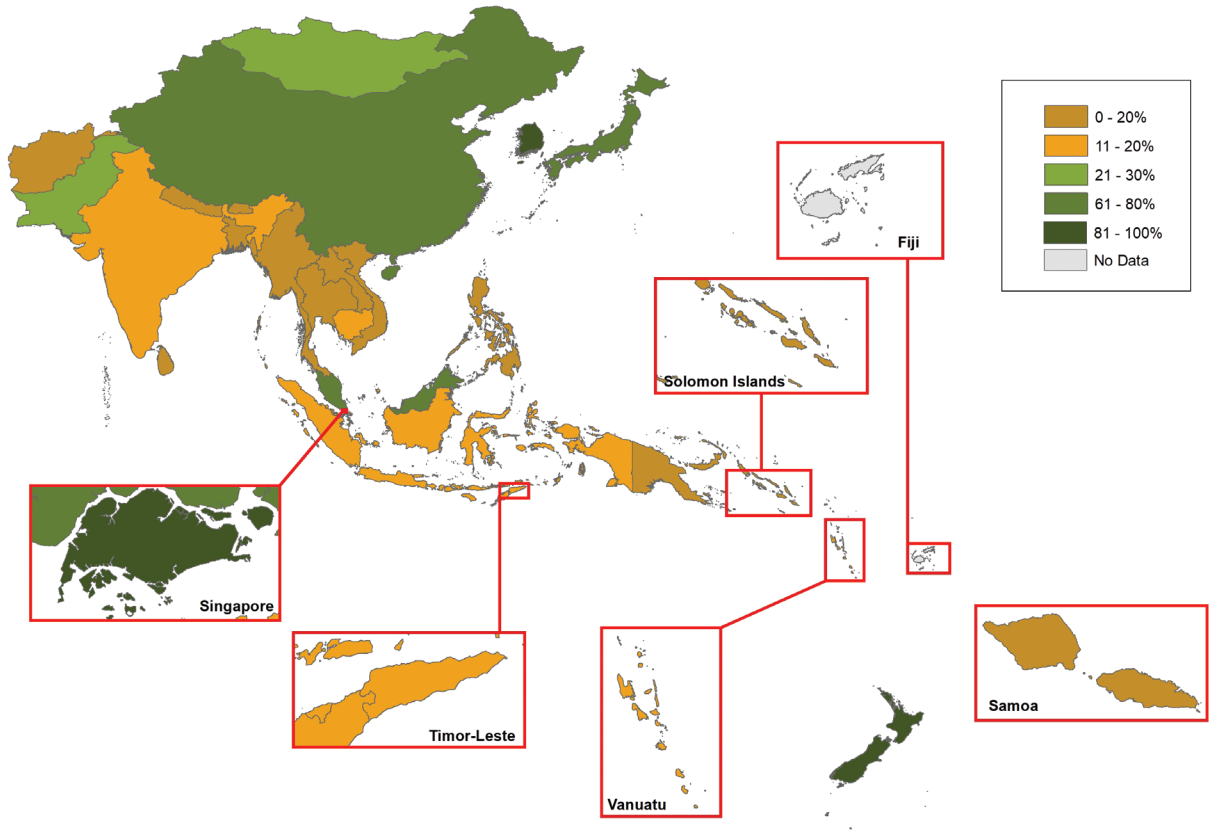
Note: This measure includes access to improved, piped water sources, shared and on-premises.

Although access to piped water is high amongst regional benchmark countries and a few of the region's emerging markets—including Bhutan, Malaysia, Fiji, and Samoa—many countries in Asia still lack widespread access to piped household water.

Moreover, there are stark differences in urban and rural access. Urban-rural divides are especially large in Papua New Guinea, the Maldives, Cambodia, and Vietnam. The urban-rural divide is particularly critical in poorly urbanized countries such as Papua New Guinea, where 87% of the population lives in rural areas, yet receives a marginal portion of sector investments. Although networked piped services may not be the most efficient option outside of urban areas, these differences indicate areas where improvements to rural water service access may need to be targeted.

Amongst low- and middle-income regional countries, Malaysia, Bhutan, Fiji, and Samoa stand out as having extended piped water services to 80 percent or more of their populations. Eleven countries, however, still have not reached coverage levels of 40 percent. Piped water services in Indonesia, Bangladesh, and Afghanistan are extended to less than 25 percent of their populations.

Access to Piped Sewerage (% of Population)

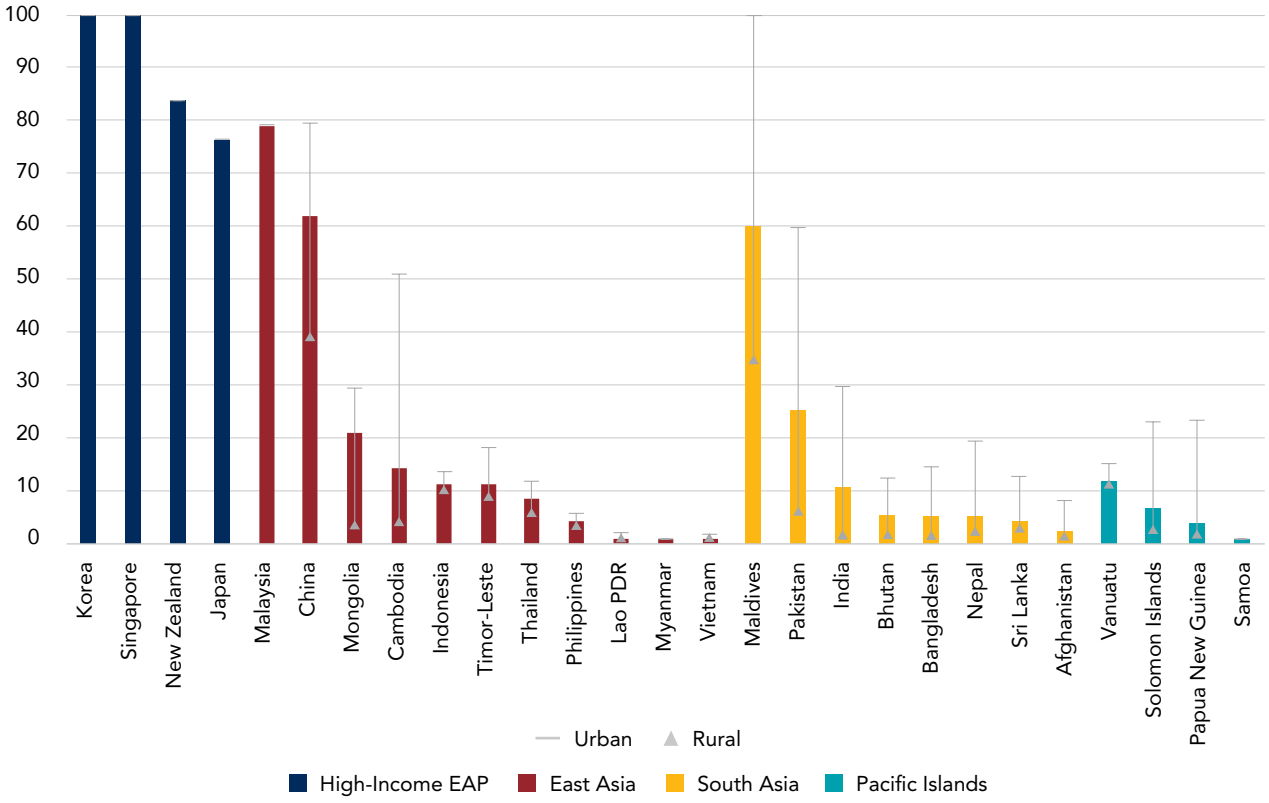


Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data), except Brunei (2016 data)

Sanitation includes the capture, storage, transport, treatment, and disposal or reuse of human excreta and wastewater. The first indicator of access focuses on the percentage of the population with household connections to centralized municipal wastewater systems. This type of networked sanitation service is the focus of reporting on the status of physical sanitation infrastructure, though attainment of SDGs, as with water, is better captured by broader measures of access to safely managed sanitation.[6]

6 See indicators for access to safely managed sanitation, http://datatopics.worldbank.org/sdgs/

Access to Piped Sewerage (% of Population)



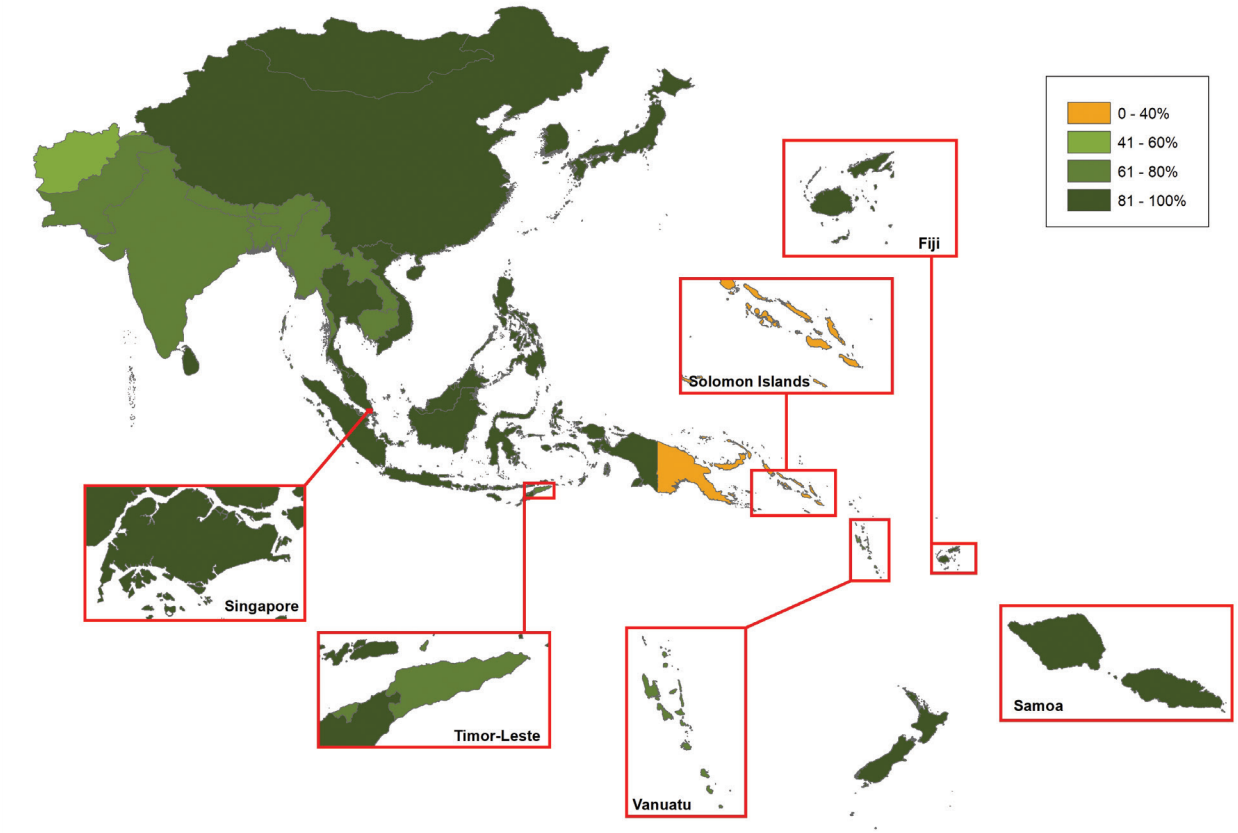
Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data), except Brunei (2016 data).

Notes: Data unavailable for Indonesia, Fiji and Solomon Islands.

Piped connection rates are generally very low, ranging from less than one percent in Myanmar and Vietnam to 79 percent in Malaysia. Piped sewerage coverage exceeds 30 percent only in China, the Maldives, and the regional high-income benchmark countries.

The rates for urban populations are much higher than the rural and overall averages, but even urban piped-connection rates are low in most countries in the region. Only the high-income benchmark countries and the Maldives, China, and Malaysia have extended urban services to more than 60 percent of the population.

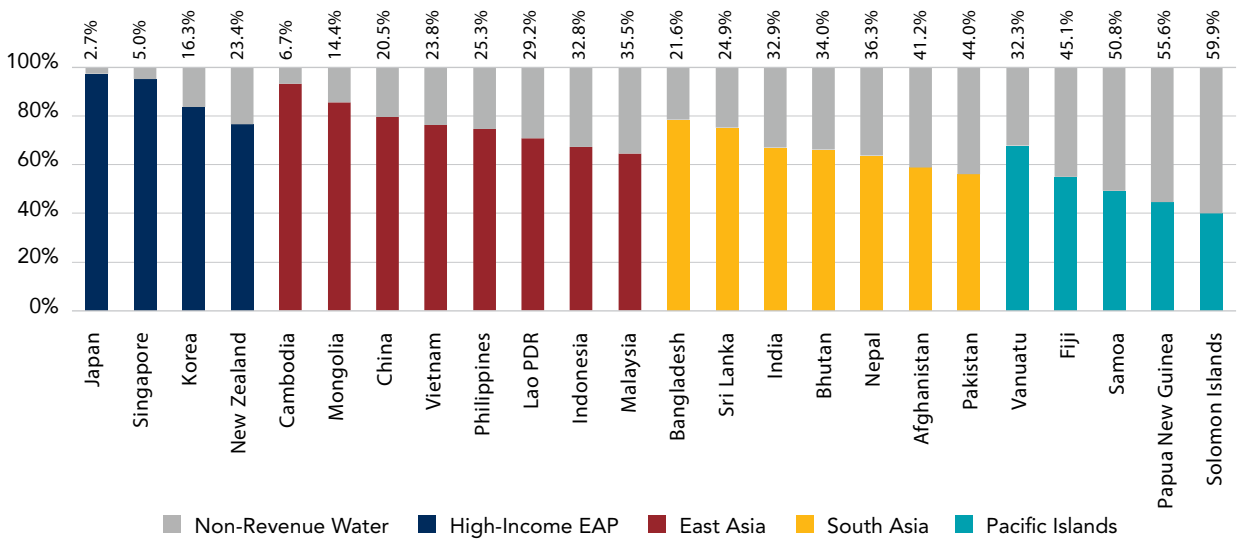
Access to Improved Sanitation (% of Population)



Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data).

Added context is provided to differentiate between access to piped household-sewerage connections and to improved sanitation, more generally. A broader measure of sanitation access would take into account access to improved sanitation facilities, including household and shared facilities, as well as non-networked treatment technologies such as septic tanks. These access rates are significantly higher than those limited to household sewerage connections, though some countries still record extremely low overall access levels to improved sanitation.

Non-Revenue Water (%)



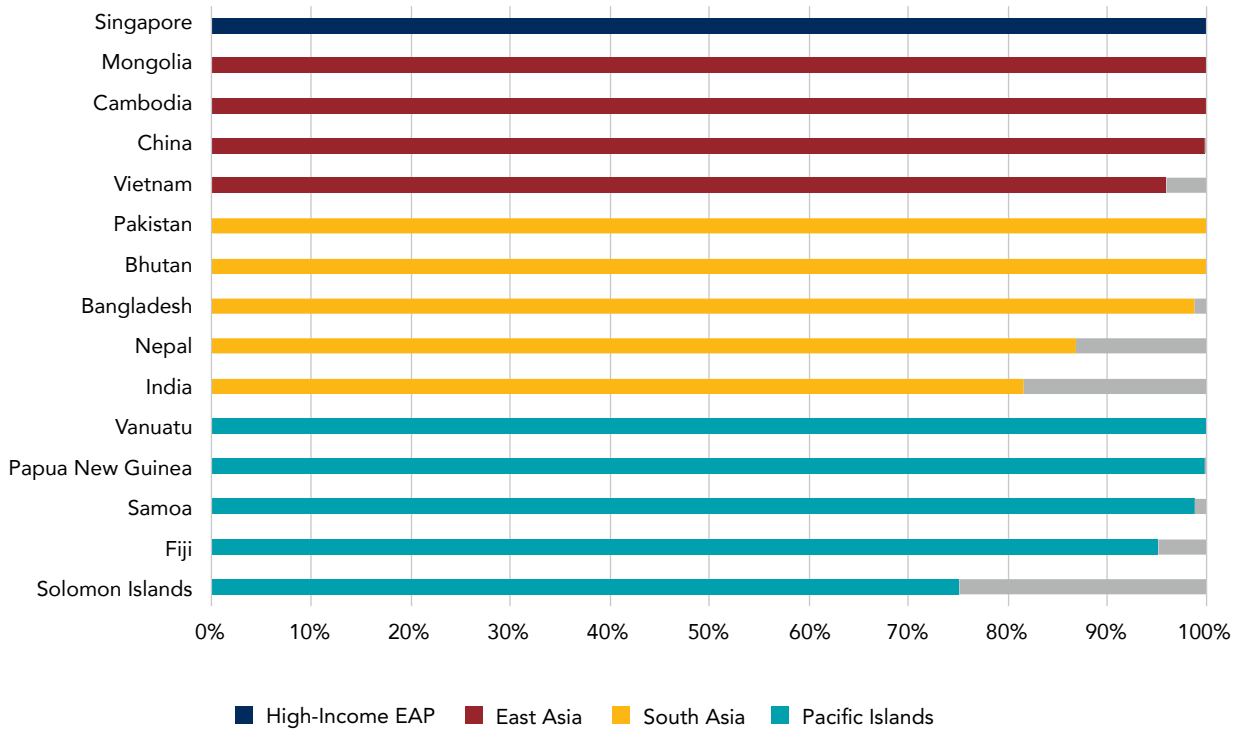
Source: Various sources and coverage at national or municipal levels, see Appendix 7.

Note: For Philippines, the NRW rate is an average of rates across Manila and Davao. For Singapore, the NRW value refers to Singapore's reported rate of 'Unaccounted-for Water'

Non-revenue water (NRW) measures the percentage of water produced by utilities that does not generate revenues, due to distribution losses, theft, or failure to collect user fees. As such, it is an indicator of both the physical condition of the distribution network and the overall efficiency of the supply system.

NRW rates are very high in several countries, reaching nearly 60 percent in the Solomon Islands. It is not uncommon for utilities in emerging Asia to lose a quarter or more of the value of water produced due to distribution losses and poor collection rates.

Quality of Water Supplied (% samples passing potable standard test)



Source: Various sources, See Appendix 7.

Water-quality compliance measures the percentage of water samples that pass residual chlorine tests or other potable water quality standards that indicate the microbial quality of water. Failure to provide clean water poses significant risks to public health. Although many utilities in the region are able to provide uncontaminated water according to published standards, recorded quality figures in India, Nepal, and Solomon Islands (amongst countries for which data is available) are particularly low.

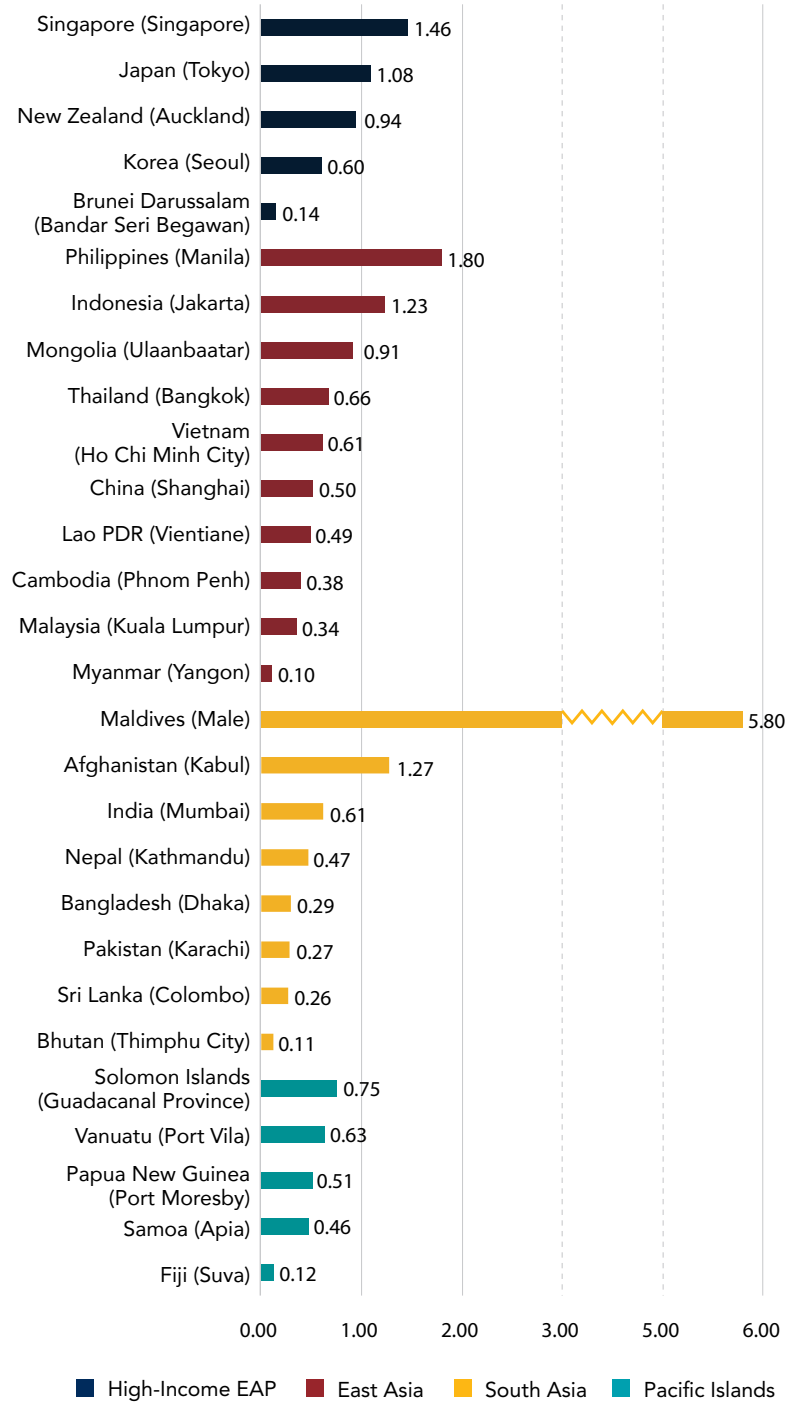
Water Tariff (Purchasing-Power-Parity-Adjusted Tariff for First 15 m^3 per Month, in US$ per m^3)

The PPP-adjusted water tariff reports the per-m^3 residential tariff rate for water services, adjusted for purchasing-power parity (PPP). The rate reported is for subsistence-level consumption, i.e., the rate for the first 15m^3 consumed in a month. Prices are in US$ at the conversion rates for their year of reporting (2017-2020).

PPP-adjusted tariffs are reported for the water utility in the largest city in each country.

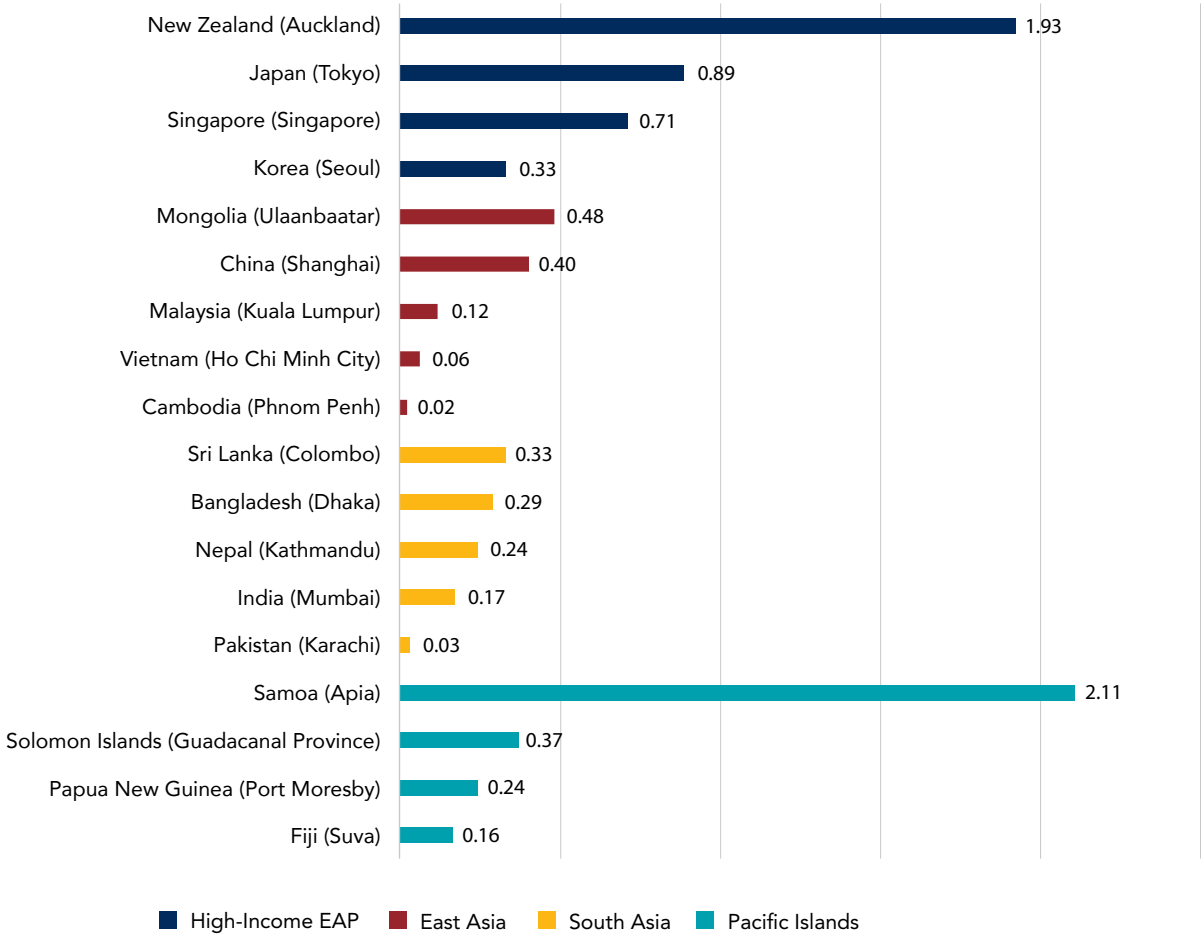
PPP-adjusted tariffs are highest in Male, Maldives; Manila, Philippines; Jakarta, Indonesia; Kabul, Afghanistan; and Singapore. Conversely, tariffs are lowest in Thimphu, Bhutan; Suva, Fiji; Yangon, Myanmar; and Bandar Seri Begawan, Brunei Darussalam.

Because tariffs may be accompanied by varying levels of cost recovery, efficiency, and re-investment, however, tariff rates must be considered alongside quality and access measures in order to make utility-specific assessments of their relative appropriateness.



Source: Various sources, see Appendix 6.

Wastewater Tariff (Purchasing-Power-Parity-Adjusted US$ per m^3)

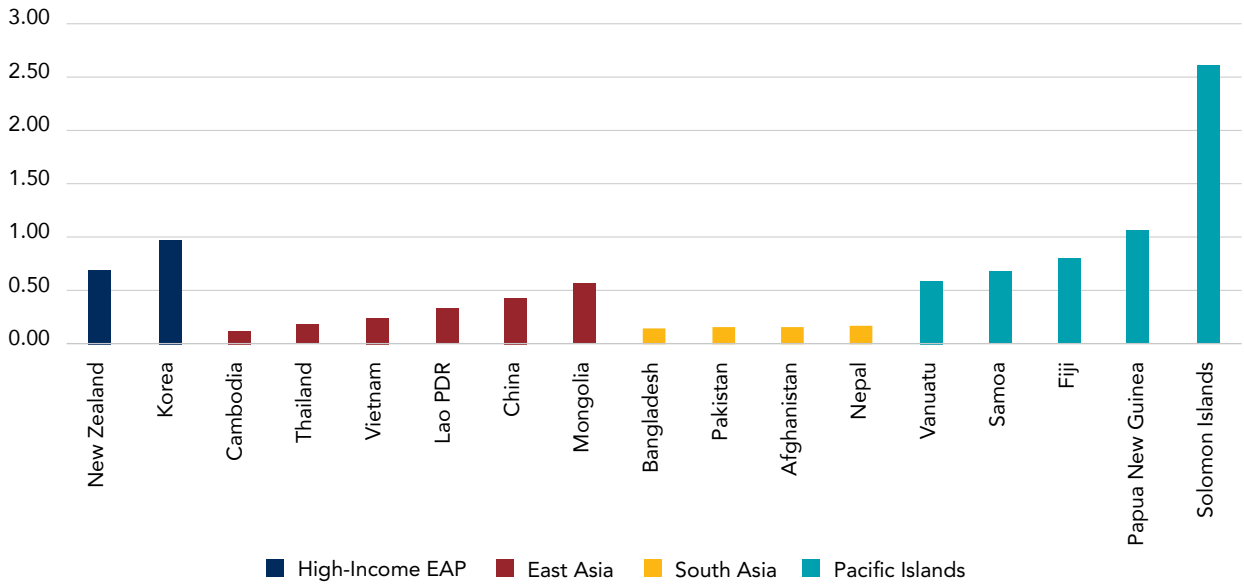


Source: Various sources, see Appendix 6

Some utilities charge separate tariffs for water and wastewater services. By charging separately for wastewater, utilities can ring-fence funds needed to improve wastewater collection and treatment.

Amongst emerging market countries in the region that charge separate wastewater tariffs, Apia, Samoa's tariff is highest.

Operational Expenditure, Water and Wastewater (US$ per m³ of water sold)

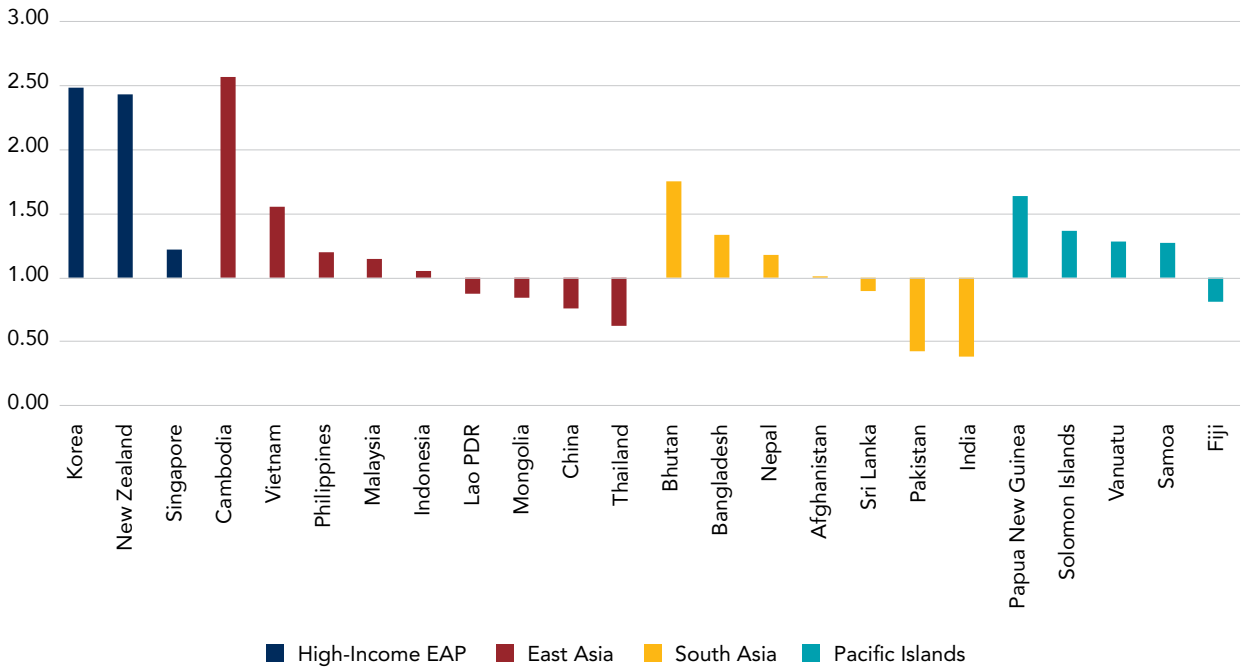


Source: IBNET and various sources; see Appendix 7.

Note: Unit Operational Expenditure, Water & Wastewater (US$/m³ water sold) is equal to the total annual operational expenses / total volume of water sold.

Reported operational expenditures for water and wastewater account for utilities' operating expenditures per cubic meter of water produced and sold. They do not always account for the costs that utilities must cover, even for operations, because some costs are covered outside of reported utility expenditures. In some cases, utilities report combined water and wastewater expenditures. Generally, the higher operational expenditures reported in high-income benchmark countries are correlated to higher quality service, high coverage rates, and higher levels of cost recovery. The high expenditures reported in Samoa and Solomon Islands, on the other hand, are associated with high NRW and high input costs.

Operational Cost Coverage Ratio



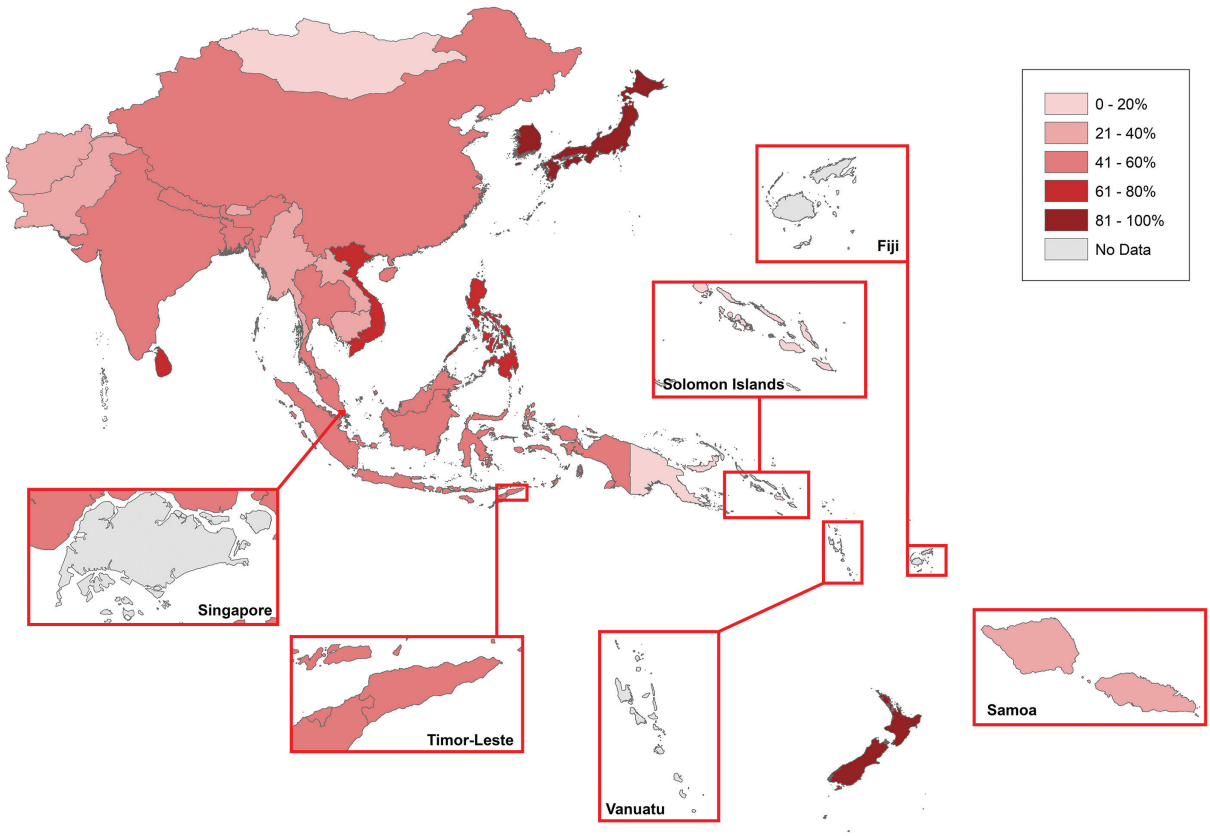
Source: Various sources, See Appendix 7.

Notes: Operational cost coverage is the ratio of total annual operational revenues to total annual operational expenditures.

The operating-expenditures coverage ratio measures utilities' total operational revenue divided by total operational expenditures. Although the measure does not include capital expenditures or debt service, it is a reasonable proxy for the capacity of utilities to attain cost-recovery levels.

Values above 1.0 indicate that revenues exceed operational expenditures. Nine countries for which data is available have attained high levels of cost recovery. In fact, Solomon Isands' operating cost coverage more than doubled between 2010 and 2018.

Rural Access to All-Season Roads (% of Population)

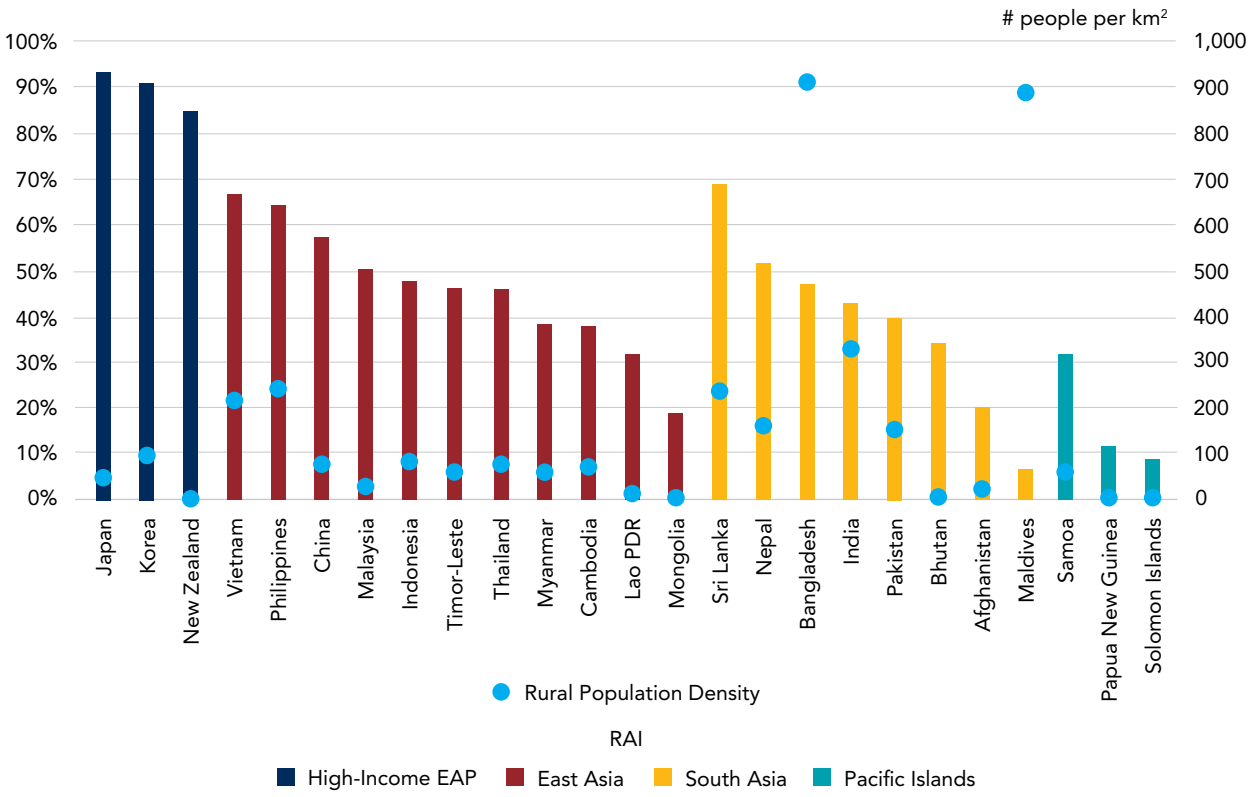


Source: Mikou et al., 2019

Rural access to roads is estimated based on the World Bank Rural Access Index (RAI) methodology (see Appendix 2). Drawing on open-access geospatial data, the estimate captures the share of the rural population within a walking distance of two kilometers to all-access roads. Rural population density provides the necessary context when considering these results, because low RAIs are more problematic, in absolute terms, in countries where rural population densities are high.[7]

7 For further comparison of RAI and rural population density data, see Appendix 1.

Rural Access Index (RAI)



Source: Mikou et al., 2019

In India, Pakistan, the Maldives, Bangladesh, and Indonesia, where rural population densities are high and RAIs are less than 50 percent, large numbers of people lack proximal access to all-season roads.

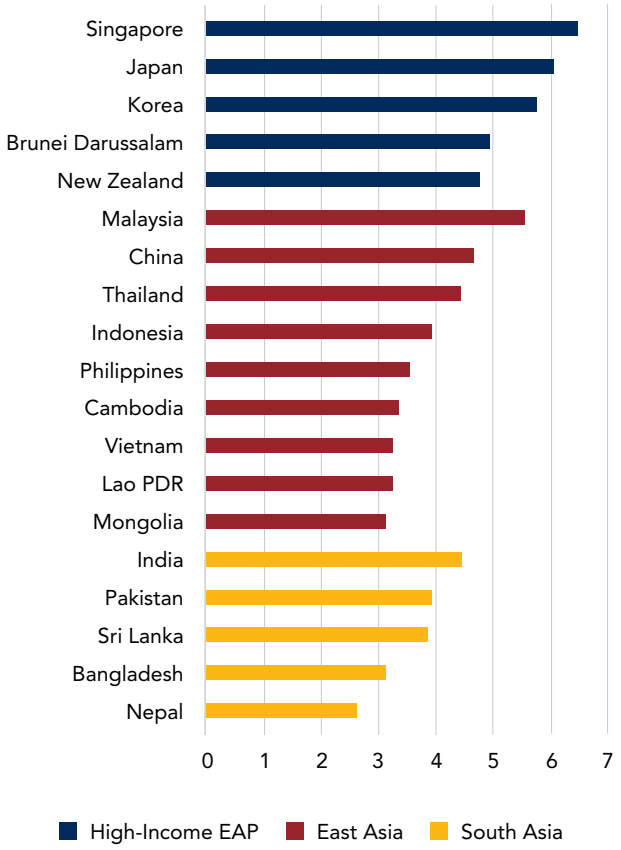
Among emerging economies, Sri Lanka, Vietnam, and the Philippines have achieved significant rural-access rates well above 60 percent. The lowest accessibility levels are found in the Maldives, the Solomon Islands, Papua New Guinea, Mongolia, and Afghanistan, where less than 20 percent of rural residents have access to paved roads within a 2-kilometer radius. High-income benchmark nations for which data is available (Japan, New Zealand, and Korea) all have ratios higher than 80 percent. The RAI is not applicable in Singapore.

Quality of Roads Infrastructure (On a Scale of 1-7, From Worst to Best)

Access to road infrastructure is not enough to attain trade and transit development goals. The quality of road infrastructure is also an important factor in minimizing the transaction costs of travel and trade and improving the efficiency and resilience of road networks. Although additional factors—for example, network connectivity and regulation—affect the quality of transport as a service, this report focuses on hard road-transport assets.

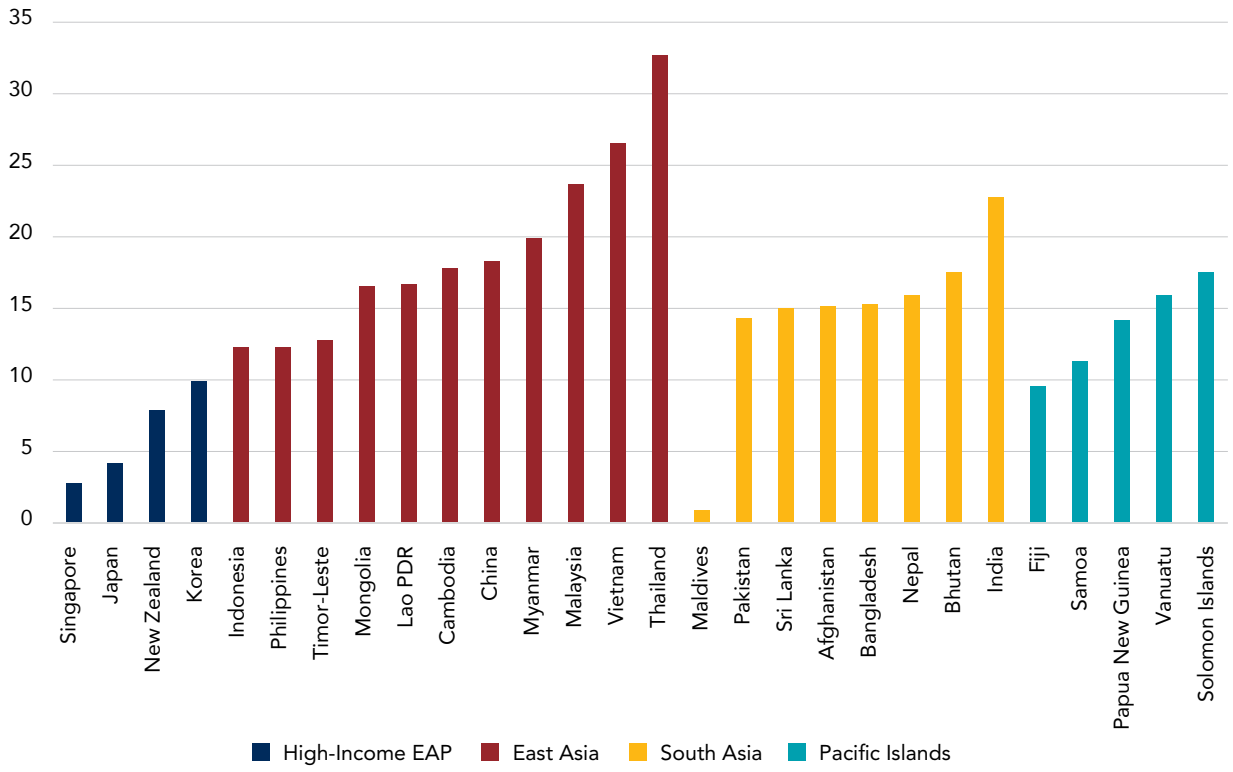
The Global Competitiveness Report compiles survey data on perceptions of road quality, with a rating of 7 being the best. The regional high-income benchmark countries and Malaysia score highest with respect to perceptions of road-infrastructure quality. On average, emerging East Asia (3.86) scores slightly better than South Asia (3.56).

Amongst emerging economies, Malaysia easily scores highest, although conditions are significantly better in West Malaysia than in East Malaysia. Nepal, on the other hand, is perceived to have the poorest road quality and is the only country to score less than 3. There is no data available on road quality for Pacific Island states.



Source: World Economic Forum, Global Competitiveness Report, 2018.

Road Traffic Death Rate (Deaths per 100,000 People per Year)



Source: WHO Global Health Repository, 2019 (using 2016 data).

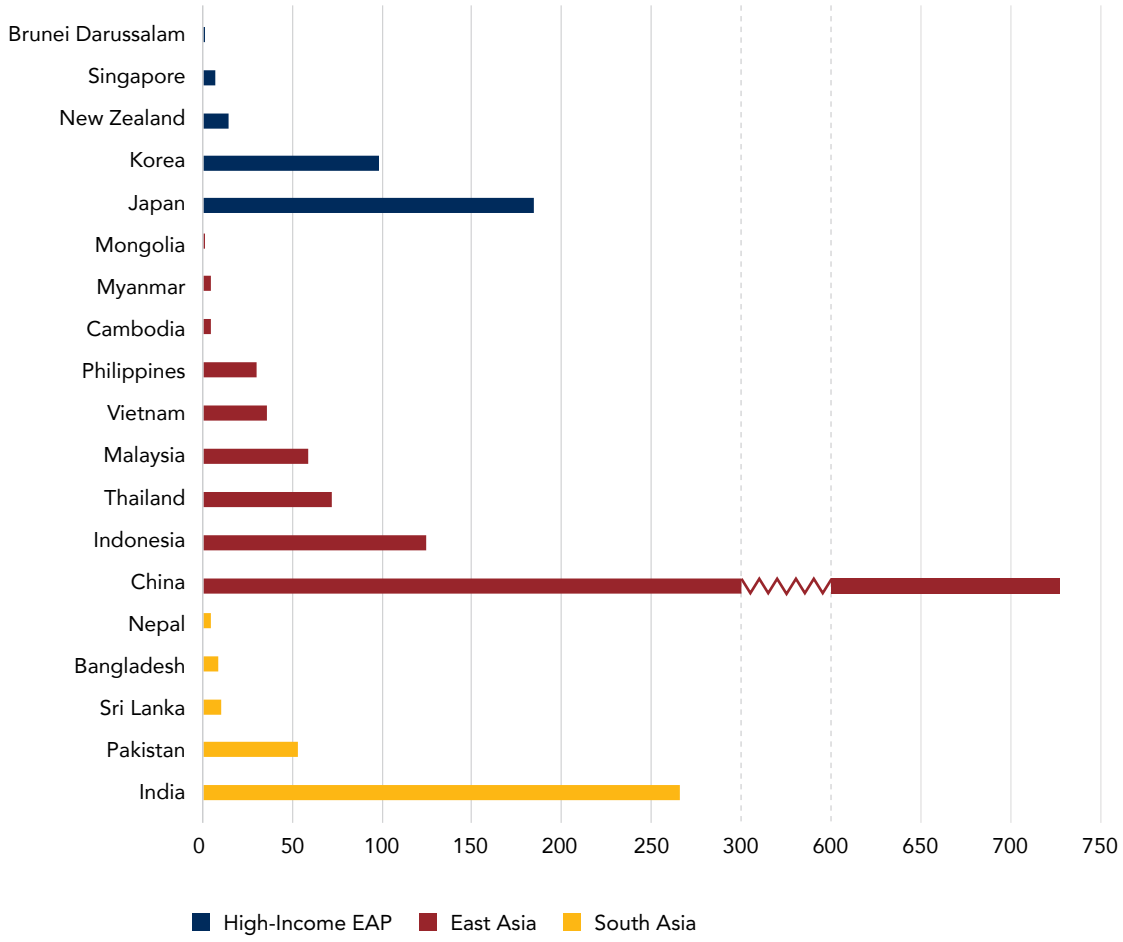
Traffic death rates are affected by road-system safety features, as well as by topography, traffic regulations, and behavioral customs. As such, although the annual traffic death rate is an indirect and partial measure of road quality, it is a useful indicator of overall road-system safety.

Singapore, the Maldives, and Japan exhibit the lowest traffic death rates, followed by New Zealand and Fiji.

Amongst emerging economies, the Maldives notably has the lowest traffic death rate (only 0.9 per 100,000 people in 2016). Thailand, Vietnam, Malaysia, and India, on the other hand, have the highest traffic death rates (more than 20 per 100,000 people).

Intra-regionally, South Asia (14.6 percent) and the Pacific Islands (13.7 percent) have lower average traffic death rates compared to East Asia (19.0 percent).

Total CO_2 Emissions from Road Transport ($MTCO_2$)



Source: IEA Statistics, Total CO_2 Emissions from Road Transport, 2019 (using 2017 data).

High-income Asia and East Asia have generally higher volumes of transport CO_2 emissions that other regions, with the exception of India. China and India - the region's two largest economies - have the largest road networks and populations and highest levels of road transport emissions.

Looking Forward

This report takes stock of the status of access, quality, and costs of infrastructure service across East Asia, South Asia and the Pacific Islands. Inevitably, the exercise can draw only on available data. Although this can bring focus to the most evident areas of need, and spur key questions about critical relationships amongst the dimensions of infrastructure service, the quality of infrastructure must be more deeply examined in order to be able to make important decisions about how and where to focus investments and development efforts. Additional research can provide a better diagnostic of the status of infrastructure, by exploring the relationships between quality and access, and by further examining linkages between status indicators; economic and human development indicators; and infrastructure governance and investment.

The results suggest that there are marked differences in access to and quality of services between countries (particularly, between low- and medium-income East Asian countries, and between ASEAN, South Asia, and the Pacific Islands), as well as between rural and urban communities. Large-scale investments are still required, particularly in water and sanitation and transport, in several low- and middle-income countries.

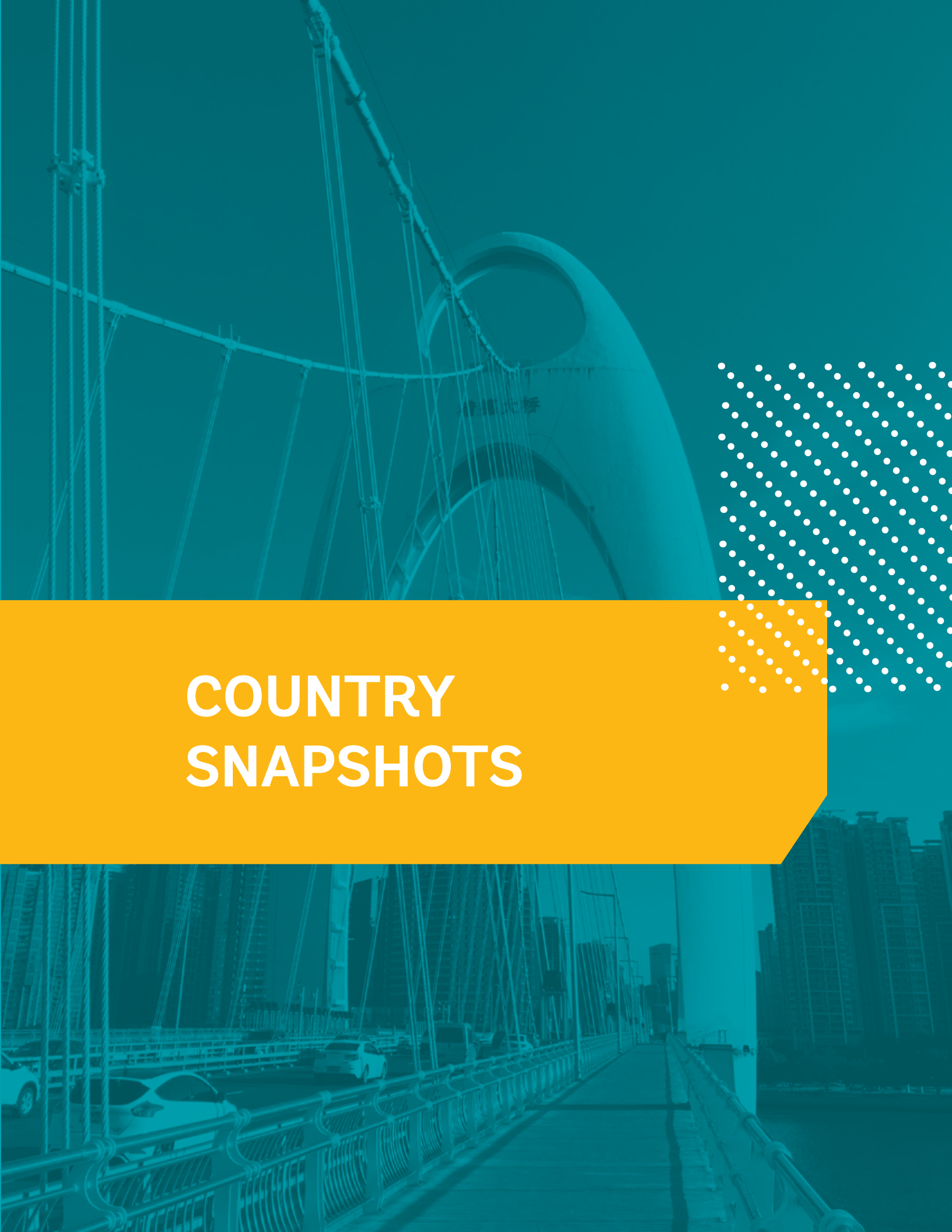
In the case of water supply, records on non-revenue water suggest that there is a need to rehabilitate aging and under-performing urban supply systems. Data also demonstrates a need to connect users to water-supply networks in Cambodia, Lao PDR, Mongolia, Myanmar, and the Philippines; across the Pacific Islands (except for Fiji); and across South Asia (except for Bhutan and the Maldives). Although extending access remains important, such developments must include upgrading existing assets and improving the maintenance and efficiency of utility operations. Urban areas require financial support to address the insufficient access and quality of sewerage connections and wastewater treatment across the region. Additionally, access to paved roads is low, particularly in Cambodia, Indonesia, Lao PDR, Mongolia, Myanmar, Papua New Guinea, Samoa, the Solomon Islands, Afghanistan, Bhutan, the Maldives, and Pakistan.

Many countries also lack updated data on access, quality, tariffs and costs, limiting the strength of regional comparisons. This is, undoubtedly, the most significant challenge with respect to understanding the status of infrastructure services. Better quality and more extensive data would also allow for deeper analysis of potential causal factors for and correlations between quality, access, and tariffs and costs. Moreover, current data is insufficient to appraise the affordability of infrastructure services or the efficiency of current approaches to delivery,

Geographically, the most notable data deficiencies are in the Pacific Islands. Topically, data is limited in the areas of cost recovery, road costing, and road quality. Moreover, the direct comparability and generalizability of tariff and cost data at the national level is compromised, because reported figures are for different years and different samples of utilities.

In addition to the issues on the previous page, these needs include up-to-date, comparable cross-country data on per-unit tariffs and costs (capital and operational), because current estimates are limited to urban areas and, often, the largest cities. This would also enable a better assessment of cost-recovery levels for both electricity and water utilities. Given the importance of water quality to public health, there is a need to collect water-quality data (such as the presence of coliforms, etc.) in piped-water systems. In general, there is little information on the cost of road construction, nor is there an objective quality assessment.

Aspects of infrastructure-services delivery are often difficult to compare across countries, not only due to data issues, but also due to the high variation in developmental priorities, physical geographies, the availability of natural-resource inputs, and complexities in the measurement of aspects such as efficiency. Nevertheless, this report provides a starting point for engaging in data-informed dialogue about priority areas for developing quality infrastructure to most effectively serve economic and social development needs.



COUNTRY SNAPSHOTS

REGIONAL OVERVIEW

Minimum, maximum, and mean values for each indicator are calculated based on data from all countries included in the study, and for which data is available.

Values in each cell are provided in the following format: minimum / **average** / maximum.

ELECTRICITY

ACCESS	
Urban (%)	73.77 / **97.60** / 100
Rural (%)	50.42 / **86.55** / 100
Total (%)	54.43 / **90.43** / 100

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.04 / **0.17** / 0.89
Average Operational Cost of Generation (US$/KWh)	0.01 / **0.08** / 0.26
Levelized Cost of Energy (US$/KWh)	0.04 / **0.10** / 0.17

QUALITY	
Electricity Quality (1–7)	2.8 / **4.9** / 6.9
T&D Losses (%)	12.28 / **22.64** / 33
System Average Interruption Duration (hours)	0 / **58.1** / 940
System Average Interruption Frequency (# per year)	0 / **28.7** / 500
CO_2 Emissions (electricity) ($MTCO_2$)	0 / **382.9** / 4618.2
Renewables (%)	0 / **29.32** / 100
Avg. Time to Connect (days)	13 / **66.93** / 179

ROAD TRANSPORT

ACCESS	
Rural Accessibility (%)	6.5 / **45.5** / 93.3

QUALITY	
Road Quality (1–7)	2.6 / **4.2** / 6.4
Traffic Deaths (# per 100,000 people per year)	0.9 / **14.9** / 32.7
CO_2 Emissions (road transport) ($MTCO_2$)	1.3 / **89.7** / 726.3

WATER & SANITATION

ACCESS	
Piped Water, Urban (%)	22.66 / **68.79** / 98.88
Piped Water, Rural (%)	2.50 / **33.69** / 83.73
Piped Water, Total (%)	14.90 / **50.20** / 98.79

TARIFF & COST	
Water Tariff (US$/$m^3$)	0.02 / **0.49** / 3.87
Water Tariff, PPP-Adjusted (US$/$m^3$)	0.10 / **0.81** / 5.80
Operational Expenditure, Water (US$/$m^3$)	0.11 / **0.62** / 2.08
Operational Cost Coverage Ratio	0.39 / **1.25** / 2.57
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.12 / **0.58** / 2.61

QUALITY	
Non-Revenue Water (%)	2.74 / **29.76** / 59.93
Water Quality (% passing chlorine test)	75.23 / **95.47** / 100

ACCESS	
Piped Sewerage, Urban (%)	1.73 / **22.43** / 79.36
Piped Sewerage, Rural (%)	1.00 / **8.94** / 38.50
Piped Sewerage, Total (%)	1.11 / **23.42** / 83.76

TARIFF & COST	
Wastewater Tariff (US$/$m^3$)	0.01 / **0.39** / 2.32
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.02 / **0.49** / 2.11
Operational Expenditure, Wastewater (US$/population served)	0 / **64.32** / 503.20

QUALITY	
Wastewater Treatment (%)	0 / **21.2** / 100
Wastewater Connection (%)	0 / **25** / 100

AFGHANISTAN

POPULATION 37,172,386 | **GDP PER CAPITA** US$521

ELECTRICITY

While overall access to all sources of electricity is quite high, access to grid electricity is only approximately 31% (World Bank Energy estimate based on utility data). Rural access in Afghanistan is lower than the regional average. Although most service-quality data are unavailable, quality is reportedly poor, leading to challenging conditions for residents and businesses. This may partly be due to the decentralized power supply across the country, with limited interconnectedness.

ACCESS	
Urban (%)	99.50
Rural (%)	97.09
Total (%)	97.70

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.10
Average Operational Cost of Generation (US$/KWh)	0.03
Levelized Cost of Energy (US$/KWh)	N/A

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	33.0
System Average Interruption Duration (hours)	–
System Average Interruption Frequency (# per year)	–
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	12.67
Avg. Time to Connect (days)	114

ROAD TRANSPORT

Road data reflects poor access and road quality. The road transport master plan prepared by the ADB estimated that 85% of the road network is in poor condition. Afghanistan experiences significantly higher traffic mortality than its regional neighbors, and a low proportion of paved roads.

ACCESS	
Rural Accessibility (%)	20.3

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	15.1
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Afghanistan ranks lower than its regional neighbors in all water-and-sanitation access indicators. With a diarrheal disease burden almost twice that of the region, significant investments in quality and access are required.

A multi-agency led Community-Led Total Sanitation project, in partnership with the government, aims to end open defecation by 2030. The initiative is expected to improve rural sanitation access.

ACCESS	
Piped Water, Urban (%)	45.10
Piped Water, Rural (%)	13.76
Piped Water, Total (%)	21.67

TARIFF & COST (KABUL)	
Water Tariff (US$/$m^3$)	0.34
Water Tariff, PPP-Adjusted (US$/$m^3$)	1.27
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.01
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.16

QUALITY	
Non-Revenue Water (%)	41.21
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	8.14
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	2.60

TARIFF & COST (KABUL)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	8.0

BANGLADESH

POPULATION 161,356,039 | **GDP PER CAPITA** US$1,698

ELECTRICITY

Rural access to electricity in Bangladesh is significantly lower than the regional average along with high transmission losses and high tariffs. Use of renewables is notably low, which may be contributing to high tariffs and limited access.

ACCESS	
Urban (%)	99.5
Rural (%)	81.28
Total (%)	88.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.08
Average Operational Cost of Generation (US$/KWh)	0.07
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	3.7
T&D Losses (%)	11.0
System Average Interruption Duration (hours)	–
System Average Interruption Frequency (# per year)	–
CO_2 Emissions (electricity) ($MTCO_2$)	36.9
Renewables (%)	1.23
Avg. Time to Connect (days)	125

ROAD TRANSPORT

The survey-based indicator shows that the quality of road infrastructure is perceived to be very poor. Dhaka has alarming levels of congestion, and the traffic death rate is also high. These factors have recently sparked major debate around the need for tariff reform as well as strict implementation of traffic regulations on both urban streets and highways.

ACCESS	
Rural Accessibility (%)	47.0

QUALITY	
Road Quality (1–7)	3.1
Traffic Deaths (# per 100,000 people per year)	15.3
CO_2 Emissions (road transport) ($MTCO_2$)	8.4

WATER & SANITATION

Water and sanitation access are significantly low, with rural areas lagging behind urban areas by a wide margin. Formal piped access remains demand-driven in urban areas. Combined with high population densities, this may lead to a high disease burden.

Rapid-response mechanisms in health centers that specialize in diarrheal disease and public-information campaigns have led to a decrease in the number of diarrheal deaths, but infrastructure services will be challenged to support further gains in sanitation.

ACCESS	
Piped Water, Urban (%)	37.08
Piped Water, Rural (%)	2.50
Piped Water, Total (%)	14.90

TARIFF & COST (DHAKA)	
Water Tariff (US$/$m^3$)	0.12
Water Tariff, PPP-Adjusted	0.29
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.11
Operational Cost Coverage Ratio	1.33
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.14

QUALITY	
Non-Revenue Water (%)	21.56
Water Quality (% passing chlorine test)	98.71

ACCESS	
Piped Sewerage, Urban (%)	14.36
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	5.24

TARIFF & COST (DHAKA)	
Wastewater Tariff (US$/$m^3$)	0.12
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.29
Operational Expenditure, Wastewater (US$/population served)	4.67

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	2.0

BHUTAN

POPULATION 754,394 | **GDP PER CAPITA** US$3,360

ELECTRICITY

Bhutan's electricity sector performs very well compared to other countries in the region in terms of access, quality, and affordability. Bhutan has attained near-total access in both urban and rural areas. Ambitious targets to reach full electrification by 2020 were revised, and Bhutan Power Corporation has continued expanding the distribution network to hard-to-reach locations, especially with greater investment in clean energy and renewables, capitalizing on high access to hydropower resources. Electricity generation costs are low, but data on T&D loss and renewable energy is missing.

ACCESS

Urban (%)	99.10
Rural (%)	96.76
Total (%)	97.70

TARIFF & COST

Avg. Tariff (US$/KWh)	0.04
Average Operational Cost of Generation (US$/KWh)	0.08
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	5.8
T&D Losses (%)	–
System Average Interruption Duration (hours)	7.1
System Average Interruption Frequency (# per year)	2.9
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	99.99
Avg. Time to Connect (days)	61

ROAD TRANSPORT

Difficult terrain and dispersed communities increase the challenge of road connectivity. This is reflected in a relatively low ratio of paved roads and higher-than-average traffic death rates. Nevertheless, road-surface conditions are generally very good.

ACCESS

Rural Accessibility (%)	34.2

QUALITY

Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	17.4
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Although Bhutan is a regional leader in aggregate access rates for water, there is still low accessibility of sanitation. Possibly as a result of this, deaths from waterborne diseases are quite high. No operational cost information is available.

ACCESS

Piped Water, Urban (%)	>99.0
Piped Water, Rural (%)	>99.0
Piped Water, Total (%)	>99.0

TARIFF & COST (THIMPHU)

Water Tariff (US$/$m^3$)	0.04
Water Tariff, PPP-Adjusted	0.11
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.75
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY

Non-Revenue Water (%)	33.96
Water Quality (% passing chlorine test)	100.00

ACCESS

Piped Sewerage, Urban (%)	12.30
Piped Sewerage, Rural (%)	1.15
Piped Sewerage, Total (%)	5.63

TARIFF & COST (THIMPHU)

Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	10.0

BRUNEI DARUSSALAM

POPULATION 428,962 | **GDP PER CAPITA** US$31,628

ELECTRICITY

Rich in fossil fuels and natural gas, Brunei Darussalam's electricity sector performs very well in terms of access, quality, and costs. Tariffs and costs are extremely low compared to other countries in the region. To reduce CO_2 emissions, the country aims to increase the share of renewable energy to 10 percent by 2035.

ACCESS	
Urban (%)	100.00
Rural (%)	100.00
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	–
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	5.4
T&D Losses (%)	6.4
System Average Interruption Duration (hours)	0.4
System Average Interruption Frequency (# per year)	0.3
CO_2 Emissions (electricity) ($MTCO_2$)	2.6
Renewables (%)	0.05
Avg. Time to Connect (days)	25

ROAD TRANSPORT

Road-quality survey scores rate Brunei Darussalam second highest in the EAP region, after Singapore. The country is amply funded from natural-resource revenues that serve a small population in a small land area. Thus, investment and maintenance of roads is well funded.

ACCESS	
Rural Accessibility (%)	–

QUALITY	
Road Quality (1–7)	4.9
Traffic Deaths (# per 100,000 people per year)	–
CO_2 Emissions (road transport) ($MTCO_2$)	1.3

WATER & SANITATION

Brunei Darussalam performs well overall, though some improvements are still needed to improve water treatment. Data on tariffs and costs is limited.

ACCESS	
Piped Water, Urban (%)	>99.0
Piped Water, Rural (%)	>99.0
Piped Water, Total (%)	>99.0

TARIFF & COST (BANDAR SERI BEGAWAN)	
Water Tariff (US$/$m^3$)	0.08
Water Tariff, PPP-Adjusted	0.14
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	–
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	–
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	–
Piped Sewerage, Rural (%)	–
Piped Sewerage, Total (%)	–

TARIFF & COST (BANDAR SERI BEGAWAN)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	-
Wastewater Connection (%)	44.0

CAMBODIA

POPULATION 16,249,798 | **GDP PER CAPITA** US$1,510

ELECTRICITY

Cambodia's electricity sector faces serious problems with respect to access, quality, and tariffs. Although urban access and T&D losses have significantly improved, access in rural areas is the lowest among East Asian countries, due to underinvestment. Losses are huge, and interruptions are frequent. These system deficiencies and high dependencies on imported oil lead to high electricity costs.

ACCESS

Urban (%)	99.06
Rural (%)	86.09
Total (%)	89.07

TARIFF & COST

Avg. Tariff (US$/KWh)	0.19
Average Operational Cost of Generation (US$/KWh)	0.08
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	3.5
T&D Losses (%)	13.7
System Average Interruption Duration (hours)	20.8
System Average Interruption Frequency (# per year)	15.4
CO_2 Emissions (electricity) ($MTCO_2$)	4.1
Renewables (%)	46.42
Avg. Time to Connect (days)	179

ROAD TRANSPORT

Cambodia's roads generally have good or fair surface conditions, but the quality of road infrastructure is still perceived as poor. The core problems seem to be low connectivity and inefficiency (ADB 2017).

ACCESS

Rural Accessibility (%)	38.1

QUALITY

Road Quality (1–7)	3.3
Traffic Deaths (# per 100,000 people per year)	17.8
CO_2 Emissions (road transport) ($MTCO_2$)	4.5

WATER & SANITATION

There is a significant disparity between access rates in urban centers (home to 21 percent of the population) and rural areas. Rural rates are below the regional average. Phnom Penh Water Authority performs well, with a low rate of non-revenue water, low operation costs, and high cost recovery, but it needs to improve wastewater treatment quality, as wastewater-treatment facilities face a severe shortage of capacity.

ACCESS

Piped Water, Urban (%)	77.28
Piped Water, Rural (%)	10.87
Piped Water, Total (%)	26.13

TARIFF & COST (PHNOM PENH)

Water Tariff (US$/$m^3$)	0.15
Water Tariff, PPP-Adjusted	0.38
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.12
Operational Cost Coverage Ratio	2.57
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.12

QUALITY

Non-Revenue Water (%)	6.74
Water Quality (% passing chlorine test)	100.00

ACCESS

Piped Sewerage, Urban (%)	50.83
Piped Sewerage, Rural (%)	3.43
Piped Sewerage, Total (%)	14.32

TARIFF & COST (PHNOM PENH)

Wastewater Tariff (US$/$m^3$)	0.02
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.02
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	10.0

CHINA

POPULATION 1,392,730,000 | **GDP PER CAPITA** US$9,771

ELECTRICITY

China's electricity sector performs generally well in terms of access, quality, and tariffs. To narrow performance gaps with respect to regional benchmarking countries, China must further reduce interruption durations and frequencies. Moreover, the time necessary for businesses to get electricity connections is the second worst in East Asia, requiring government administrative attention. As the largest producer of CO_2 emissions in the world, a focus on renewables will remain important.

ACCESS	
Urban (%)	100.00
Rural (%)	99.97
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.10
Average Operational Cost of Generation (US$/KWh)	0.05
Levelized Cost of Energy (US$/KWh)	0.04

QUALITY	
Electricity Quality (1–7)	5.0
T&D Losses (%)	5.1
System Average Interruption Duration (hours)	0.8
System Average Interruption Frequency (# per year)	0.2
CO_2 Emissions (electricity) ($MTCO_2$)	4618.2
Renewables (%)	26.00
Avg. Time to Connect (days)	32

ROAD TRANSPORT

Road-quality surveys and the ratio of paved roads are relatively high compared to regional averages. From 2012 to 2017, the country built and renovated 1.28 million kilometers of rural roads. Though it has been investing intensively in transport, further effort is needed to enhance the rural transport network.

ACCESS	
Rural Accessibility (%)	57.4

QUALITY	
Road Quality (1–7)	.6
Traffic Deaths (# per 100,000 people per year)	18.2
CO_2 Emissions (road transport) ($MTCO_2$)	726.3

WATER & SANITATION

Utility performance information from IBNET comes mostly from Shandong Province. Although China provides better access and quality of water and sanitation than other countries in the region, tariffs and operating costs remain high.

ACCESS	
Piped Water, Urban (%)	92.22
Piped Water, Rural (%)	53.77
Piped Water, Total (%)	76.06

TARIFF & COST (SHANGHAI)	
Water Tariff (US$/$m^3$)	0.28
Water Tariff, PPP-Adjusted	0.50
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.41
Operational Cost Coverage Ratio	0.76
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.43

QUALITY	
Non-Revenue Water (%)	20.54
Water Quality (% passing chlorine test)	99.86

ACCESS	
Piped Sewerage, Urban (%)	79.36
Piped Sewerage, Rural (%)	38.50
Piped Sewerage, Total (%)	62.18

TARIFF & COST (SHANGHAI)	
Wastewater Tariff (US$/$m^3$)	0.23
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.40
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	56.0

FIJI

POPULATION 883,483 | **GDP PER CAPITA** US$6,267

ELECTRICITY

Fiji's electricity sector performs very well compared to other countries in terms of access, quality, and tariffs. Access in rural areas has significantly improved. Gains in rural electrification are attributed to proactive government initiatives, including grid extensions. The government needs to focus attention on reducing the time for businesses to secure electricity services.

ACCESS	
Urban (%)	99.92
Rural (%)	91.06
Total (%)	96.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	–
Average Operational Cost of Generation (US$/KWh)	0.10
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	5.0
System Average Interruption Frequency (# per year)	4.7
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	45.02
Avg. Time to Connect (days)	81

ROAD TRANSPORT

Though the ratio of paved roads is very high compared to other countries in the Pacific Islands, it is still relatively poor overall. As with other Pacific Island states, data on transport is limited.

ACCESS	
Rural Accessibility (%)	–

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	9.6
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Fiji is a regional leader in aggregate access rates for piped water, with recent significant increases in rural access. Data is not available for piped-wastewater access, but there has been a notable increase in the wastewater-treatment rate since 2017 (up from 4 percent). Tariffs and operating costs are cheaper than regional averages, though cost recovery has not been attained.

ACCESS	
Piped Water, Urban (%)	97.01
Piped Water, Rural (%)	74.32
Piped Water, Total (%)	86.97

TARIFF & COST (SUVA)	
Water Tariff (US$/$m^3$)	0.08
Water Tariff, PPP-Adjusted	0.12
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.75
Operational Cost Coverage Ratio	0.81
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.80

QUALITY	
Non-Revenue Water (%)	45.06
Water Quality (% passing chlorine test)	95.11

ACCESS	
Piped Sewerage, Urban (%)	–
Piped Sewerage, Rural (%)	–
Piped Sewerage, Total (%)	–

TARIFF & COST (SUVA)	
Wastewater Tariff (US$/$m^3$)	0.10
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.16
Operational Expenditure, Wastewater (US$/population served)	33.07

QUALITY	
Wastewater Treatment (%)	10.0
Wastewater Connection (%)	39.0

INDIA

POPULATION 1,352,617,328 | **GDP PER CAPITA** US$2,010

ELECTRICITY

Access in rural areas lags in comparison to urban regions, due to distribution challenges. The tariff rate is below the regional average, due to decreasing renewable tariffs, especially for solar power. The quality of supply is rated moderately, but fares slightly better than the regional average. Although there is scope for improvement, several steps are being taken by the government to reduce losses and strengthen the T&D network, especially in rural areas.

ACCESS

Urban (%)	99.21
Rural (%)	89.31
Total (%)	92.62

TARIFF & COST

Avg. Tariff (US$/KWh)	0.09
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	0.09

QUALITY

Electricity Quality (1–7)	4.7
T&D Losses (%)	18.6
System Average Interruption Duration (hours)	4.6
System Average Interruption Frequency (# per year)	2.6
CO_2 Emissions (electricity) ($MTCO_2$)	1100.4
Renewables (%)	15.34
Avg. Time to Connect (days)	53

ROAD TRANSPORT

The Government of India has laid out an ambitious target of building 83.6 thousand kilometers of roads in five years, at an estimated cost of US$108 billion. In 2017 alone, India constructed 9,800 kilometers of roads, doubling the build rate from the previous year. India fares better than other countries in South Asia for road quality, but the traffic death rate remains high, with about 1.2 million road deaths from 2007 to 2017.

ACCESS

Rural Accessibility (%)	42.8

QUALITY

Road Quality (1–7)	4.4
Traffic Deaths (# per 100,000 people per year)	22.6
CO_2 Emissions (road transport) ($MTCO_2$)	256.7

WATER & SANITATION

India has good rates of access for both piped water and sanitation, coupled with relatively low tariffs. Nevertheless, utility data from 2009 across 12 provinces revealed poor continuity, high system losses, and inadequate cost recovery.

ACCESS

Piped Water, Urban (%)	67.87
Piped Water, Rural (%)	31.53
Piped Water, Total (%)	43.74

TARIFF & COST (MUMBAI)

Water Tariff (US$/$m^3$)	0.19
Water Tariff, PPP-Adjusted	0.61
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	0.39
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY

Non-Revenue Water (%)	32.90
Water Quality (% passing chlorine test)	81.7

ACCESS

Piped Sewerage, Urban (%)	29.55
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	10.56

TARIFF & COST (MUMBAI)

Wastewater Tariff (US$/$m^3$)	0.05
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.17
Operational Expenditure, Wastewater (US$/population served)	0.00

QUALITY

Wastewater Treatment (%)	19.2
Wastewater Connection (%)	11.7

INDONESIA

POPULATION 267,663,435 | **GDP PER CAPITA** US$3,894

ELECTRICITY

Access to electricity is widespread across the country, but rural areas still have the lowest connectivity rates. In general, most quality indicators are high. Nevertheless, Indonesia's share of renewable energy is low, propelling the government to increase efforts to reach its target of 23 percent of energy derived from renewables by 2025.

ACCESS

Urban (%)	100.00
Rural (%)	95.66
Total (%)	98.14

TARIFF & COST

Avg. Tariff (US$/KWh)	0.09
Average Operational Cost of Generation (US$/KWh)	0.10
Levelized Cost of Energy (US$/KWh)	0.12

QUALITY

Electricity Quality (1–7)	4.4
T&D Losses (%)	9.4
System Average Interruption Duration (hours)	2.6
System Average Interruption Frequency (# per year)	2.2
CO_2 Emissions (electricity) ($MTCO_2$)	195.9
Renewables (%)	10.65
Avg. Time to Connect (days)	32

ROAD TRANSPORT

Indonesia has relatively high-quality roads and a high ratio of paved roads, which contributes to a low road traffic death rate.

ACCESS

Rural Accessibility (%)	47.9

QUALITY

Road Quality (1–7)	3.9
Traffic Deaths (# per 100,000 people per year)	12.2
CO_2 Emissions (road transport) ($MTCO_2$)	124.5

WATER & SANITATION

Indonesia has low access to piped water by regional standards, and the lowest wastewater-treatment score in the region. There is limited information on piped sanitation access. Tariff and NRW data come from PALYJA, a private consortium operating in western Jakarta, where both reported costs and tariffs are relatively high.

ACCESS

Piped Water, Urban (%)	22.66
Piped Water, Rural (%)	13.01
Piped Water, Total (%)	18.28

TARIFF & COST (JAKARTA)

Water Tariff (US$/$m^3$)	0.46
Water Tariff, PPP-Adjusted	1.23
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.05
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY

Non-Revenue Water (%)	32.80
Water Quality (% passing chlorine test)	–

ACCESS

Piped Sewerage, Urban (%)	9.52
Piped Sewerage, Rural (%)	13.53
Piped Sewerage, Total (%)	11.34

TARIFF & COST (JAKARTA)

Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	1.0
Wastewater Connection (%)	2.5

LAO PDR

POPULATION 7,061,507 | **GDP PER CAPITA** US$2,542

ELECTRICITY

Although access has significantly improved due to rapid power-generation capacity increases, Lao PDR still has not reached a regional average level. Interruption duration and frequency, although improved, also remain problematic, largely due to natural disasters and poor electricity-equipment quality.

ACCESS

Urban (%)	99.50
Rural (%)	90.51
Total (%)	93.60

TARIFF & COST

Avg. Tariff (US$/KWh)	0.08
Average Operational Cost of Generation (US$/KWh)	0.09
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	4.8
T&D Losses (%)	12.3
System Average Interruption Duration (hours)	4.0
System Average Interruption Frequency (# per year)	22.7
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	81.00
Avg. Time to Connect (days)	87

ROAD TRANSPORT

The Lao PDR road network is vulnerable to climate change impacts, including floods and landslides. Every year, a significant amount of the government budget is spent on disaster recovery and emergency repair. In addition, a large segment of the population lives in rural areas where road access is restricted in the rainy season. Lao PDR is located in the hub of Greater Mekong Sub-region (GMS) countries, and has seen an increase in transit traffic. Therefore, it is essential to undertake climate resilient road improvement and raise the standards of the core road network serving regional connectivity to the ASEAN standards.

ACCESS

Rural Accessibility (%)	31.5

QUALITY

Road Quality (1–7)	3.2
Traffic Deaths (# per 100,000 people per year)	16.6
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Although Lao PDR has the largest water resources per capita in Asia, access and quality are still serious problems, especially for sanitation, which is characterized by an inadequate sewerage system and poor wastewater-treatment facilities.

ACCESS

Piped Water, Urban (%)	82.34
Piped Water, Rural (%)	32.28
Piped Water, Total (%)	49.48

TARIFF & COST (VIENTIANE)

Water Tariff (US$/$m^3$)	0.19
Water Tariff, PPP-Adjusted	0.49
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	0.87
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.33

QUALITY

Non-Revenue Water (%)	29.17
Water Quality (% passing chlorine test)	–

ACCESS

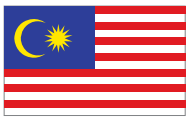
Piped Sewerage, Urban (%)	1.94
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	1.11

TARIFF & COST (VIENTIANE)

Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	<1.0



MALAYSIA

POPULATION 31,528,585 | **GDP PER CAPITA** US$11,373

ELECTRICITY

The electricity sector performs very well compared to the rest of the region. Per-capita consumption is the third largest in the region, after Brunei (9.3) and Singapore (9.0), although the gap remains large. Malaysia is expected to further increase supply to support economic growth and also aims to decrease dependence on fossil fuels by investing in renewables.

ACCESS	
Urban (%)	100.00
Rural (%)	100.00
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.10
Average Operational Cost of Generation (US$/KWh)	0.06
Levelized Cost of Energy (US$/KWh)	0.11

QUALITY	
Electricity Quality (1–7)	5.9
T&D Losses (%)	5.9
System Average Interruption Duration (hours)	0.5
System Average Interruption Frequency (# per year)	0.5
CO_2 Emissions (electricity) ($MTCO_2$)	106.9
Renewables (%)	9.96
Avg. Time to Connect (days)	24

ROAD TRANSPORT

Malaysia made rapid improvements in road-surface conditions and now enjoys the second-highest-rated roads in the region, after Singapore. Nevertheless, the traffic death rate is slightly higher than the regional average. Because the motorcycle is a popular mode of transportation, further improvement of road quality and safety for motorcyclists is important.

ACCESS	
Rural Accessibility (%)	50.1

QUALITY	
Road Quality (1–7)	5.5
Traffic Deaths (# per 100,000 people per year)	23.6
CO_2 Emissions (road transport) ($MTCO_2$)	58.9

WATER & SANITATION

Malaysia is a regional leader in access (in terms of piped water and wastewater) and sanitation quality (in terms of DALY rate, and treatment rate). Significant increases in wastewater-treatment rates are major gains. Tariffs are generally lower than in regional neighbors, although operating costs are slightly higher. Malaysia needs to focus on further reducing non-revenue water levels.

ACCESS	
Piped Water, Urban (%)	98.88
Piped Water, Rural (%)	81.20
Piped Water, Total (%)	94.54

TARIFF & COST (KUALA LUMPUR)	
Water Tariff (US$/$m^3$)	0.13
Water Tariff, PPP-Adjusted	0.34
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.15
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	35.50
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	–
Piped Sewerage, Rural (%)	–
Piped Sewerage, Total (%)	79.18

TARIFF & COST (KUALA LUMPUR)	
Wastewater Tariff (US$/$m^3$)	0.05
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.12
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	61.6
Wastewater Connection (%)	31.8

MALDIVES

POPULATION 515,696 | **GDP PER CAPITA** US$10,331

ELECTRICITY

Maldives has 100% electricity access since 2008. It is dependent on fossil fuels, mostly imports, for its electricity needs. The tariffs are above the regional average mostly due to the geographical disadvantages and high dependence on foreign oil. The Government's SREP (Scaling Up Renewable Energy Program) is transforming its Energy Sector by building in-house RE capacity and improving national energy security.

ACCESS	
Urban (%)	99.70
Rural (%)	99.86
Total (%)	99.80

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.31
Average Operational Cost of Generation (US$/KWh)	0.30-0.40
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	168.0
System Average Interruption Frequency (# per year)	2.5
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	1.28
Avg. Time to Connect (days)	75

ROAD TRANSPORT

Since Maldives is a collection of many small islands and atolls, the need for and availability of land transportation is minimal. Except for a few islands, the land area of islands is very small – most of them are less than a square kilometer. Land transport vehicles are found in the capital island, Male. However, a key issue facing infrastructure, including roads, stems from climate change risks especially rising sea levels. Resilient infrastructure tends to require large upfront costs, which is fiscally challenging in a context such as the Maldives, where the unit cost of construction per capita is already higher than other countries due to the large geographical dispersion of the islands.

ACCESS	
Rural Accessibility (%)	6.5

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	0.9
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Freshwater resources in the Maldives are scarce, with the main source being shallow groundwater aquifers. These have depleted in many areas due to over-extraction causing saltwater intrusion. Rooftop rainwater harvesting is widely practiced in the Atolls and in Male, desalinated water is distributed through a piped network.
Untreated wastewater continues to be discharged in to the sea, leading to risks to the sustainability of the tourism industry and potential health risks to the population. Improving sewerage systems and fecal sludge management are needed.

ACCESS	
Piped Water, Urban (%)	98.30
Piped Water, Rural (%)	15.00
Piped Water, Total (%)	47.80

TARIFF & COST (MALE)	
Water Tariff (US$/$m^3$)	3.87
Water Tariff, PPP-Adjusted	5.80
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	–
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	–
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	>99.0
Piped Sewerage, Rural (%)	34.24
Piped Sewerage, Total (%)	60.13

TARIFF & COST (MALE)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	–
Wastewater Connection (%)	<1.0

MONGOLIA

POPULATION 3,170,208 | **GDP PER CAPITA** US$4,122

ELECTRICITY

Compared with other EAP neighbors, Mongolia scores relatively low on electricity access (especially for rural areas), quality, and share of renewables, even though end users' tariffs are relatively low.

ACCESS	
Urban (%)	99.82
Rural (%)	55.74
Total (%)	85.87

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.06
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	4
T&D Losses (%)	11.4
System Average Interruption Duration (hours)	62.0
System Average Interruption Frequency (# per year)	15.0
CO_2 Emissions (electricity) ($MTCO_2$)	12.8
Renewables (%)	7.00
Avg. Time to Connect (days)	79

ROAD TRANSPORT

Mongolia's road infrastructure is generally underdeveloped, with a low percentage of paved roads and modest surface conditions. Nevertheless, the ratio of paved roads has increased to approximately 11.5% in 2017 from 6% in 2013, due to government efforts to connect all provinces to Ulaanbataar by paved roads.

ACCESS	
Rural Accessibility (%)	18.9

QUALITY	
Road Quality (1–7)	3.1
Traffic Deaths (# per 100,000 people per year)	16.5
CO_2 Emissions (road transport) ($MTCO_2$)	1.4

WATER & SANITATION

With the exception of urban access to water, Mongolia will need to focus a lot on expanding the national access to both water and sanitation, preferably through reduced tariffs and costs. Nevertheless, high water quality and waste-treatment rates have delivered positive outcomes, notably the small diarrheal burden.

ACCESS	
Piped Water, Urban (%)	34.45
Piped Water, Rural (%)	4.98
Piped Water, Total (%)	25.13

TARIFF & COST (ULAANBAATAR)	
Water Tariff (US$/$m^3$)	0.33
Water Tariff, PPP-Adjusted	0.91
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.36
Operational Cost Coverage Ratio	0.84
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.56

QUALITY	
Non-Revenue Water (%)	14.40
Water Quality (% passing chlorine test)	100.00

ACCESS	
Piped Sewerage, Urban (%)	29.41
Piped Sewerage, Rural (%)	3.11
Piped Sewerage, Total (%)	21.09

TARIFF & COST (ULAANBAATAR)	
Wastewater Tariff (US$/$m^3$)	0.17
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.48
Operational Expenditure, Wastewater (US$/population served)	9.24

QUALITY	
Wastewater Treatment (%)	10.0
Wastewater Connection (%)	33.0

MYANMAR

POPULATION 53,708,395 | **GDP PER CAPITA** US$1,326

ELECTRICITY

Despite recent electricity-access improvements, Myanmar remains below regional average rates, especially for rural areas. Data is unavailable for many quality indicators. Interestingly, the country has a high share of renewables, possibly due to focused policy over the last few years and abundant natural resources.

ACCESS	
Urban (%)	92.55
Rural (%)	59.92
Total (%)	69.81

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.06
Average Operational Cost of Generation (US$/KWh)	0.07
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	30.3
System Average Interruption Frequency (# per year)	26.4
CO_2 Emissions (electricity) ($MTCO_2$)	8.1
Renewables (%)	58.85
Avg. Time to Connect (days)	70

ROAD TRANSPORT

Road quality data is missing, but traffic death rates are high, indicating poor conditions. Rural accessibility is also considerably low.

ACCESS	
Rural Accessibility (%)	38.3

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	19.9
CO_2 Emissions (road transport) ($MTCO_2$)	4.3

WATER & SANITATION

New data reflects a recent increase in water-access rates, although they remain low by regional standards, particularly in rural areas. Sanitation access and quality (DALY rate) remain poor.

ACCESS	
Piped Water, Urban (%)	56.85
Piped Water, Rural (%)	10.50
Piped Water, Total (%)	24.55

TARIFF & COST (YANGON)	
Water Tariff (US$/$m^3$)	0.02
Water Tariff, PPP-Adjusted	0.10
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	–
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	–
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	<1.0
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	<1.0

TARIFF & COST (YANGON)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	<1.0

NEPAL

POPULATION 28,087,871 | **GDP PER CAPITA** US$1,034

ELECTRICITY

The electricity sector performs fairly in terms of access and tariff levels, but quality data is limited. The country has an excellent record of clean-energy consumption, attributable to high access to hydropower. Nevertheless, system losses are high, and energy-quality survey scores are low, indicating a need for focused investments to improve the distribution network.

ACCESS	
Urban (%)	98.69
Rural (%)	94.74
Total (%)	95.51

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.09
Average Operational Cost of Generation (US$/KWh)	0.01
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	2.8
T&D Losses (%)	25.0
System Average Interruption Duration (hours)	–
System Average Interruption Frequency (# per year)	–
CO_2 Emissions (electricity) ($MTCO_2$)	0.0
Renewables (%)	100.00
Avg. Time to Connect (days)	49

ROAD TRANSPORT

Facing similar challenges as Bhutan, the road quality information is inconsistent with public reports. Save the Children recently rated Nepal one of the worst places for a child to fall ill, due to poor connectivity. These evaluations were done after severe infrastructure damage resulted from the 2015 earthquake. The World Bank is leading several investment projects to improve access and quality of all-weather roads.

ACCESS	
Rural Accessibility (%)	51.7

QUALITY	
Road Quality (1–7)	2.6
Traffic Deaths (# per 100,000 people per year)	15.9
CO_2 Emissions (road transport) ($MTCO_2$)	4.8

WATER & SANITATION

Poor rural water and sanitation access is accentuated by a high incidence of death from diarrheal disease. Sanitation access is low, even in urban areas. Tariff information and quality indicators are limited. Sanitation-practices reforms are being promoted by the government and local and international non-governmental organizations (NGOs), but information on government programs is limited.

ACCESS	
Piped Water, Urban (%)	55.31
Piped Water, Rural (%)	45.51
Piped Water, Total (%)	47.40

TARIFF & COST (KATHMANDU)	
Water Tariff (US$/$m^3$)	0.17
Water Tariff, PPP-Adjusted	0.47
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.17
Operational Cost Coverage Ratio	1.18
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.17

QUALITY	
Non-Revenue Water (%)	36.30
Water Quality (% passing chlorine test)	86.84

ACCESS	
Piped Sewerage, Urban (%)	19.22
Piped Sewerage, Rural (%)	1.75
Piped Sewerage, Total (%)	5.13

TARIFF & COST (KATHMANDU)	
Wastewater Tariff (US$/$m^3$)	0.08
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.24
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	10.0

PAKISTAN

POPULATION 212,215,030 | **GDP PER CAPITA** US$1,482

ELECTRICITY

Although electricity access in Pakistan is in-line with regional averages, the average interruption duration and frequency values are much higher. This is apparent from frequent power outages due to load-shedding. The government plans to add more capacity and diversify the energy sector by commissioning more hydropower plants, with the support of China under the China-Pakistan Economic Corridor (CPEC) program.

ACCESS	
Urban (%)	100.00
Rural (%)	54.14
Total (%)	70.79

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.12
Average Operational Cost of Generation (US$/KWh)	0.05
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	2.9
T&D Losses (%)	17.1
System Average Interruption Duration (hours)	99.0
System Average Interruption Frequency (# per year)	90.0
CO_2 Emissions (electricity) ($MTCO_2$)	54.5
Renewables (%)	31.43
Avg. Time to Connect (days)	113

ROAD TRANSPORT

Pakistan has fair road-quality indicators, but rural accessibility is only 39.9 percent. Low accessibility shows high scope for improvement for the rural population. Pakistan's major road-expansion projects are financed by China's CPEC and BRI programs.

ACCESS	
Rural Accessibility (%)	39.9

QUALITY	
Road Quality (1–7)	3.9
Traffic Deaths (# per 100,000 people per year)	14.3
CO_2 Emissions (road transport) ($MTCO_2$)	52.6

WATER & SANITATION

Piped water and sewerage access are low, even in urban areas. Pakistan's sanitation quality is also poor, as evidenced by a high DALY rate and low wastewater treatment. Water services, even in the larger cities, are intermittent.

ACCESS	
Piped Water, Urban (%)	51.26
Piped Water, Rural (%)	15.25
Piped Water, Total (%)	28.37

TARIFF & COST (KARACHI)	
Water Tariff (US$/$m^3$)	0.08
Water Tariff, PPP-Adjusted	0.27
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	0.43
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.15

QUALITY	
Non-Revenue Water (%)	44.00
Water Quality (% passing chlorine test)	100.00

ACCESS	
Piped Sewerage, Urban (%)	59.87
Piped Sewerage, Rural (%)	5.37
Piped Sewerage, Total (%)	25.23

TARIFF & COST (KARACHI)	
Wastewater Tariff (US$/$m^3$)	0.01
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.03
Operational Expenditure, Wastewater (US$/population served)	2.79

QUALITY	
Wastewater Treatment (%)	1.0
Wastewater Connection (%)	10.0

PAPUA NEW GUINEA

POPULATION 8,606,316 | **GDP PER CAPITA** US$2,730

ELECTRICITY

Papua New Guinea's (PNG's) low rural electricity access is a key challenge. PNG is working with multiple agencies, including the World Bank and the Asian Development Bank (ADB) to build energy-sector capacity. PNG's high interruption duration and frequency indicates significant limitations in T&D networks.

ACCESS	
Urban (%)	81.03
Rural (%)	50.42
Total (%)	54.43

TARIFF & COST	
Avg. Tariff (US$/KWh)	–
Average Operational Cost of Generation (US$/KWh)	0.10-0.12
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	940.0
System Average Interruption Frequency (# per year)	500.0
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	34.53
Avg. Time to Connect (days)	66

ROAD TRANSPORT

PNG's below-average rural accessibility indicates limited connectivity. Poor road conditions and a paved-roads rate of only 3.5 percent exacerbate high traffic-death rates.

ACCESS	
Rural Accessibility (%)	11.7

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	14.2
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Piped water and sewerage access are low, particularly in rural areas. Moreover, urban NRW is very high. Sanitation quality is also poor, as evidenced by a high DALY rate and low wastewater treatment and connection.

ACCESS	
Piped Water, Urban (%)	55.43
Piped Water, Rural (%)	12.80
Piped Water, Total (%)	18.38

TARIFF & COST (PORT MORESBY)	
Water Tariff (US$/$m^3$)	0.43
Water Tariff, PPP-Adjusted	0.51
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.90
Operational Cost Coverage Ratio	1.64
Operational Expenditure, Water and Wastewater (US$/$m^3$)	1.06

QUALITY	
Non-Revenue Water (%)	55.55
Water Quality (% passing chlorine test)	99.88

ACCESS	
Piped Sewerage, Urban (%)	23.30
Piped Sewerage, Rural (%)	1.0
Piped Sewerage, Total (%)	3.92

TARIFF & COST (PORT MORESBY)	
Wastewater Tariff (US$/$m^3$)	0.20
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.24
Operational Expenditure, Wastewater (US$/population served)	33.22

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	10.0

PHILIPPINES

POPULATION 106,651,922 | GDP PER CAPITA US$3,103

ELECTRICITY

Although access is widespread, and losses are low, energy consumption per capita is also very low. This implies that generation capacity is inadequate to meet rapidly increasing demand. Access in rural areas increased significantly in 2016, due to the government's strategic rural-electrification program.

ACCESS	
Urban (%)	96.40
Rural (%)	90.02
Total (%)	93.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.17
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	0.12

QUALITY	
Electricity Quality (1–7)	4.2
T&D Losses (%)	9.1
System Average Interruption Duration (hours)	3.6
System Average Interruption Frequency (# per year)	2.2
CO_2 Emissions (electricity) ($MTCO_2$)	63.1
Renewables (%)	25.41
Avg. Time to Connect (days)	37

ROAD TRANSPORT

Road-quality surveys show that the quality of road infrastructure is perceived as very poor. Manila, in particular, is challenged by heavy congestion. Although surface conditions have improved, more than one in four roads has a poor surface condition, largely attributable to underinvestment and lack of maintenance, especially in rural areas.

ACCESS	
Rural Accessibility (%)	64.1

QUALITY	
Road Quality (1–7)	3.5
Traffic Deaths (# per 100,000 people per year)	12.3
CO_2 Emissions (road transport) ($MTCO_2$)	30.0

WATER & SANITATION

Quality data from 25 utilities in the IBNET database (2009) shows reasonable coverage (38 percent of the urban population) across Luzon, Visayas, and Mindanao. Overall, however, the country has limited access to water and sanitation, compared to regional averages. Moreover, the quality of water supplied, and the levels of wastewater treatment are very poor.

ACCESS	
Piped Water, Urban (%)	46.81
Piped Water, Rural (%)	34.26
Piped Water, Total (%)	40.12

TARIFF & COST (MANILA)	
Water Tariff (US$/$m^3$)	0.71
Water Tariff, PPP-Adjusted	1.80
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.20
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	25.33
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	5.72
Piped Sewerage, Rural (%)	3.04
Piped Sewerage, Total (%)	4.29

TARIFF & COST (MANILA)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	63.0
Wastewater Connection (%)	4.1

SAMOA

POPULATION 196,130 | **GDP PER CAPITA** US$4,183

ELECTRICITY

The electricity sector performs very well compared to other countries in the region in terms of access, but tariff and quality information is limited. Government investments are underway to increase solar-energy sourcing. Rural electrification has also seen recent improvement.

ACCESS	
Urban (%)	100.00
Rural (%)	96.08
Total (%)	96.80

TARIFF & COST	
Avg. Tariff (US$/KWh)	–
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	35.9
System Average Interruption Frequency (# per year)	15.8
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	30.35
Avg. Time to Connect (days)	34

ROAD TRANSPORT

Targeted investments have increased the climate resilience of road infrastructure. Enhanced Road Access Projects, supported by both the World Bank and AusAid, have contributed. In the last decade, Samoa has also implemented significant traffic-related regulatory changes—most notably switching the vehicle driving side.

ACCESS	
Rural Accessibility (%)	31.6

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	11.3
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Despite high rates of piped-water access, Samoa has the second-highest NRW in the region. This may be a contributing factor to high costs, in addition to high input costs. There has been slow improvement to the very low rates of piped-wastewater access.

ACCESS	
Piped Water, Urban (%)	90.07
Piped Water, Rural (%)	83.73
Piped Water, Total (%)	84.90

TARIFF & COST (APIA)	
Water Tariff (US$/$m^3$)	0.30
Water Tariff, PPP-Adjusted	0.46
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.27
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.67

QUALITY	
Non-Revenue Water (%)	50.84
Water Quality (% passing chlorine test)	98.84

ACCESS	
Piped Sewerage, Urban (%)	<1.0
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	<1.0

TARIFF & COST (APIA)	
Wastewater Tariff (US$/$m^3$)	1.35
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	2.11
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	–
Wastewater Connection (%)	–

SINGAPORE

POPULATION 5,638,676 | **GDP PER CAPITA** US$64,582

ELECTRICITY

Singapore enjoys full coverage and reliable supply of electricity across the island state. Transmission and distribution losses and service interruptions are minimal.

ACCESS	
Urban (%)	100.00
Rural (%)	100.00
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.16
Average Operational Cost of Generation (US$/KWh)	0.12
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	6.9
T&D Losses (%)	1.8
System Average Interruption Duration (hours)	0.1
System Average Interruption Frequency (# per year)	0.1
CO_2 Emissions (electricity) ($MTCO_2$)	20.7
Renewables (%)	1.82
Avg. Time to Connect (days)	26

ROAD TRANSPORT

Although data is unavailable for the RAI (because the city-state is urban), Singapore has widespread access to a high-quality roads system, with progressive technologies for safety and traffic control.

ACCESS	
Rural Accessibility (%)	–

QUALITY	
Road Quality (1–7)	6.4
Traffic Deaths (# per 100,000 people per year)	2.8
CO_2 Emissions (road transport) ($MTCO_2$)	6.7

WATER & SANITATION

Water and sanitation coverage are total in Singapore. Singapore's urban water strategy is well known for its progressive approach to water security, conservation, and use of advanced technologies, including water reuse. The corporatized water and wastewater utility operates at a near-total cost recovery level and has the lowest non-revenue water recorded in the region.

ACCESS	
Piped Water, Urban (%)	>99.0
Piped Water, Rural (%)	–
Piped Water, Total (%)	>99.0

TARIFF & COST	
Water Tariff (US$/$m^3$)	1.25
Water Tariff, PPP-Adjusted	1.46
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	1.22
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	5.00
Water Quality (% passing chlorine test)	100.00

ACCESS	
Piped Sewerage, Urban (%)	>99.0
Piped Sewerage, Rural (%)	–
Piped Sewerage, Total (%)	>99.0

TARIFF & COST	
Wastewater Tariff (US$/$m^3$)	0.61
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.71
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	100.0
Wastewater Connection (%)	100.0

SOLOMON ISLANDS

POPULATION 652,858 | **GDP PER CAPITA** US$2,138

ELECTRICITY

Despite its small population and middle-low-income status, the Solomon Islands suffer from limited supply and high electricity tariffs. Although urban access has improved significantly, there is a need to increase access. Data for most of the quality indicators are lacking.

ACCESS

Urban (%)	73.77
Rural (%)	59.59
Total (%)	62.90

TARIFF & COST

Avg. Tariff (US$/KWh)	0.89
Average Operational Cost of Generation (US$/KWh)	0.26
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	3.1
System Average Interruption Frequency (# per year)	1.5
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	2.26
Avg. Time to Connect (days)	53

ROAD TRANSPORT

Roads in the Solomon Islands are scarcely paved and extremely vulnerable to climate change impacts. With the country ranked among the ten countries with the highest vulnerability and exposure to natural disaster risks, the road infrastructure is vulnerable to serious damage. This is compounded by the lack of routine maintenance. Further, the mountainous terrain presents an additional construction challenge. This has prompted increased technical support from development agencies on design and implementation readiness of the government's priority transport projects as well as on enhancing resilience to weather hazards and climate change.

ACCESS

Rural Accessibility (%)	9.3

QUALITY

Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	17.4
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Water access, although low, has improved, but sanitation access indicators are missing. Levels of NRW are extremely high, indicating deterioration of Guadalcanal Province's water-distribution network. Wastewater treatment is a key area of improvement.

ACCESS

Piped Water, Urban (%)	70.50
Piped Water, Rural (%)	38.88
Piped Water, Total (%)	46.24

TARIFF & COST (GUADALCANAL PROVINCE)

Water Tariff (US$/$m^3$)	0.75
Water Tariff, PPP-Adjusted	0.75
Operational Expenditure, Water and Wastewater (US$/$m^3$)	2.08
Operational Cost Coverage Ratio	1.37
Operational Expenditure, Water and Wastewater (US$/$m^3$)	2.61

QUALITY

Non-Revenue Water (%)	59.93
Water Quality (% passing chlorine test)	75.23

ACCESS

Piped Sewerage, Urban (%)	22.96
Piped Sewerage, Rural (%)	1.98
Piped Sewerage, Total (%)	6.87

TARIFF & COST (GUADALCANAL PROVINCE)

Wastewater Tariff (US$/$m^3$)	0.37
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.37
Operational Expenditure, Wastewater (US$/population served)	503.20

QUALITY

Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	30.0

SRI LANKA

POPULATION 21,670,000 | **GDP PER CAPITA** US$4,102

ELECTRICITY

Sri Lanka has above-average electricity access and a high share of renewables for production. Sri Lanka has aimed at 100 percent renewable electricity generation by 2050. The cost of renewable energy, in particular wind and solar, has and is expected to continue to drop, which is expected to reduce overall costs of electricity generation and tariff rates.

ACCESS

Urban (%)	100.00
Rural (%)	96.99
Total (%)	97.54

TARIFF & COST

Avg. Tariff (US$/KWh)	0.14
Average Operational Cost of Generation (US$/KWh)	0.12
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	4.0
T&D Losses (%)	7.0
System Average Interruption Duration (hours)	4.0
System Average Interruption Frequency (# per year)	3.0
CO_2 Emissions (electricity) ($MTCO_2$)	9.9
Renewables (%)	48.48
Avg. Time to Connect (days)	100.00

ROAD TRANSPORT

With a lower percentage of paved roads, Sri Lanka faces a road-quality challenge. Although rural accessibility is high, the aim should be to improve road conditions and traffic safety. The World Bank is working closely with the government on the Transport Connectivity and Asset Management Project to improve road network connectivity and quality.

ACCESS

Rural Accessibility (%)	68.7

QUALITY

Road Quality (1–7)	3.8
Traffic Deaths (# per 100,000 people per year)	14.9
CO_2 Emissions (road transport) ($MTCO_2$)	10.6

WATER & SANITATION

Sri Lanka has poor sanitation-access and wastewater-treatment rates, especially in rural areas, but its overall DALY rate is not as high as might be expected. Rural access to water is also low, and high levels of NRW in Colombo suggest a need to improve urban networks.

ACCESS

Piped Water, Urban (%)	73.83
Piped Water, Rural (%)	30.27
Piped Water, Total (%)	38.28

TARIFF & COST (COLOMBO)

Water Tariff (US$/$m^3$)	0.09
Water Tariff, PPP-Adjusted	0.26
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.13
Operational Cost Coverage Ratio	0.90
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY

Non-Revenue Water (%)	24.90
Water Quality (% passing chlorine test)	–

ACCESS

Piped Sewerage, Urban (%)	12.59
Piped Sewerage, Rural (%)	2.30
Piped Sewerage, Total (%)	4.19

TARIFF & COST (COLOMBO)

Wastewater Tariff (US$/$m^3$)	0.11
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.33
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	2.5

THAILAND

POPULATION 69,428,524 | **GDP PER CAPITA** US$7,274

ELECTRICITY

Thailand has a well-maintained electricity-generation and distribution system that provides widespread access to electricity services. The government could turn its focus to reducing tariffs and exploring cost-efficiency options via renewable sources and technological innovation.

ACCESS	
Urban (%)	100.00
Rural (%)	100.00
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.11
Average Operational Cost of Generation (US$/KWh)	0.04
Levelized Cost of Energy (US$/KWh)	0.08

QUALITY	
Electricity Quality (1–7)	5.2
T&D Losses (%)	6.2
System Average Interruption Duration (hours)	0.4
System Average Interruption Frequency (# per year)	0.7
CO_2 Emissions (electricity) ($MTCO_2$)	88.2
Renewables (%)	8.54
Avg. Time to Connect (days)	30

ROAD TRANSPORT

In terms of road quality, Thailand has developed a strong infrastructure base with fair quality. Nevertheless, rural road access and road-traffic safety remain areas in need of improvement.

ACCESS	
Rural Accessibility (%)	46.1

QUALITY	
Road Quality (1–7)	4.4
Traffic Deaths (# per 100,000 people per year)	32.7
CO_2 Emissions (road transport) ($MTCO_2$)	71.6

WATER & SANITATION

Access to piped supply is above the regional average, but access to piped household sanitation and sewerage-treatment and connection rates remain extremely low. There is little data available on the quality of water supplied.

ACCESS	
Piped Water, Urban (%)	86.77
Piped Water, Rural (%)	54.33
Piped Water, Total (%)	70.29

TARIFF & COST (BANGKOK)	
Water Tariff (US$/$m^3$)	0.25
Water Tariff, PPP-Adjusted	0.66
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	0.62
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.18

QUALITY	
Non-Revenue Water (%)	–
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	11.91
Piped Sewerage, Rural (%)	5.41
Piped Sewerage, Total (%)	8.61

TARIFF & COST (BANGKOK)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	<1.0
Wastewater Connection (%)	<1.0

TIMOR-LESTE

POPULATION 1,267,972 | **GDP PER CAPITA** US$2,036

ELECTRICITY

The electricity sector has seen slight improvement in recent years, with respect to access. Tariff and quality data remain limited. The time needed for businesses to acquire power connectivity is higher than the regional average.

ACCESS	
Urban (%)	100.00
Rural (%)	71.89
Total (%)	80.38

TARIFF & COST	
Avg. Tariff (US$/KWh)	–
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	–

QUALITY	
Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	–
System Average Interruption Frequency (# per year)	–
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	0.00
Avg. Time to Connect (days)	93

ROAD TRANSPORT

Rural road accessibility is relatively low. Although road-quality data is missing, high traffic death rates indicate road condition problems. The government has affirmed a clear intention to invest in improving road connectivity and quality, especially in rural areas. Damages are attributed to the poor weather resilience of current infrastructure.

ACCESS	
Rural Accessibility (%)	46.1

QUALITY	
Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	12.7
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

There has been a notable increase in water access. The biggest challenge for the urban water sector is improving efficiency. Dili's master plan and legal framework for billing and pricing is in progress. Sanitation access remains very low. There is little utility information available and a high burden of diarrheal disease. No wastewater tariff or utility operational cost data are available. Tariffs are established, but the installation of meters and consistency of billing collection is low (ADB, 2015a).

ACCESS	
Piped Water, Urban (%)	82.67
Piped Water, Rural (%)	56.71
Piped Water, Total (%)	64.55

TARIFF & COST (DILI)	
Water Tariff (US$/$m^3$)	–
Water Tariff, PPP-Adjusted	–
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–
Operational Cost Coverage Ratio	–
Operational Expenditure, Water and Wastewater (US$/$m^3$)	–

QUALITY	
Non-Revenue Water (%)	–
Water Quality (% passing chlorine test)	–

ACCESS	
Piped Sewerage, Urban (%)	18.15
Piped Sewerage, Rural (%)	8.33
Piped Sewerage, Total (%)	11.30

TARIFF & COST (DILI)	
Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY	
Wastewater Treatment (%)	5.0
Wastewater Connection (%)	6.0

VANUATU

POPULATION 292,680 | **GDP PER CAPITA** US$3,124

ELECTRICITY

Vanuatu's low rural electricity access is a key challenge. The government's energy roadmap lists "100% access and 65% renewable based electricity generation" as key targets.

ACCESS

Urban (%)	92.67
Rural (%)	52.74
Total (%)	62.78

TARIFF & COST

Avg. Tariff (US$/KWh)	0.61
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	–

QUALITY

Electricity Quality (1–7)	–
T&D Losses (%)	–
System Average Interruption Duration (hours)	7.3
System Average Interruption Frequency (# per year)	5.1
CO_2 Emissions (electricity) ($MTCO_2$)	–
Renewables (%)	21.26
Avg. Time to Connect (days)	120

ROAD TRANSPORT

Due to the climatic and geographic features of Vanuatu, road infrastructure is heavily exposed to climate and natural disasters. This is compounded by high sensitivity of the road network to heavy rainfall, flooding, and landslides due to poor structural characteristics and inadequate road maintenance. Close to 90 percent of the network is unsealed, making it frequently impassable during heavy rain. In addition, much of the road network is situated on the perimeter of the islands and is extremely vulnerable to cyclone and storm surges with even minor sea level increases. For this reason, a strong focus on climate resilient transport is needed.

ACCESS

Rural Accessibility (%)	–

QUALITY

Road Quality (1–7)	–
Traffic Deaths (# per 100,000 people per year)	15.9
CO_2 Emissions (road transport) ($MTCO_2$)	–

WATER & SANITATION

Access to water is far below the regional average, although water quality is rated at 100 percent. Nevertheless, the high diarrheal burden indicates a lack of proper sanitation and a lack of clean water access in rural areas.

ACCESS

Piped Water, Urban (%)	78.47
Piped Water, Rural (%)	37.25
Piped Water, Total (%)	47.62

TARIFF & COST (PORT VILA)

Water Tariff (US$/$m^3$)	0.61
Water Tariff, PPP-Adjusted	0.63
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.59
Operational Cost Coverage Ratio	1.28
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.59

QUALITY

Non-Revenue Water (%)	32.28
Water Quality (% passing chlorine test)	100.00

ACCESS

Piped Sewerage, Urban (%)	15.23
Piped Sewerage, Rural (%)	11.01
Piped Sewerage, Total (%)	12.07

TARIFF & COST (PORT VILA)

Wastewater Tariff (US$/$m^3$)	–
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	–
Operational Expenditure, Wastewater (US$/population served)	–

QUALITY

Wastewater Treatment (%)	–
Wastewater Connection (%)	–

VIETNAM

POPULATION 95,540,395 | **GDP PER CAPITA** US$2,567

ELECTRICITY

Vietnam has attained nearly universal access to electricity. However, rapid growth in demand places a pressure on increasing capacity, quality, and efficiency of the electricity infrastructure. While average tariff rates are higher than some regional peers, continuous tariff reform is necessary to keep up the required investment rate.

ACCESS	
Urban (%)	100.00
Rural (%)	100.00
Total (%)	100.00

TARIFF & COST	
Avg. Tariff (US$/KWh)	0.08
Average Operational Cost of Generation (US$/KWh)	–
Levelized Cost of Energy (US$/KWh)	0.17

QUALITY	
Electricity Quality (1–7)	4.3
T&D Losses (%)	9.1
System Average Interruption Duration (hours)	2.1
System Average Interruption Frequency (# per year)	1.6
CO_2 Emissions (electricity) ($MTCO_2$)	71.6
Renewables (%)	36.73
Avg. Time to Connect (days)	31

ROAD TRANSPORT

In terms of roads quality, Vietnam falls behind many of its regional neighbors. With heavy usage of motorbikes and frequent congestion, Vietnam needs to concentrate attention on improving surface conditions and reducing traffic death rates.

ACCESS	
Rural Accessibility (%)	66.7

QUALITY	
Road Quality (1–7)	3.2
Traffic Deaths (# per 100,000 people per year)	26.4
CO_2 Emissions (road transport) ($MTCO_2$)	35.8

WATER & SANITATION

Urban access is fair, but piped sanitation services are very limited. Wastewater treatment and connection scores are also very low, although Vietnam has a lower burden of diarrheal disease.

ACCESS	
Piped Water, Urban (%)	81.00
Piped Water, Rural (%)	22.14
Piped Water, Total (%)	42.87

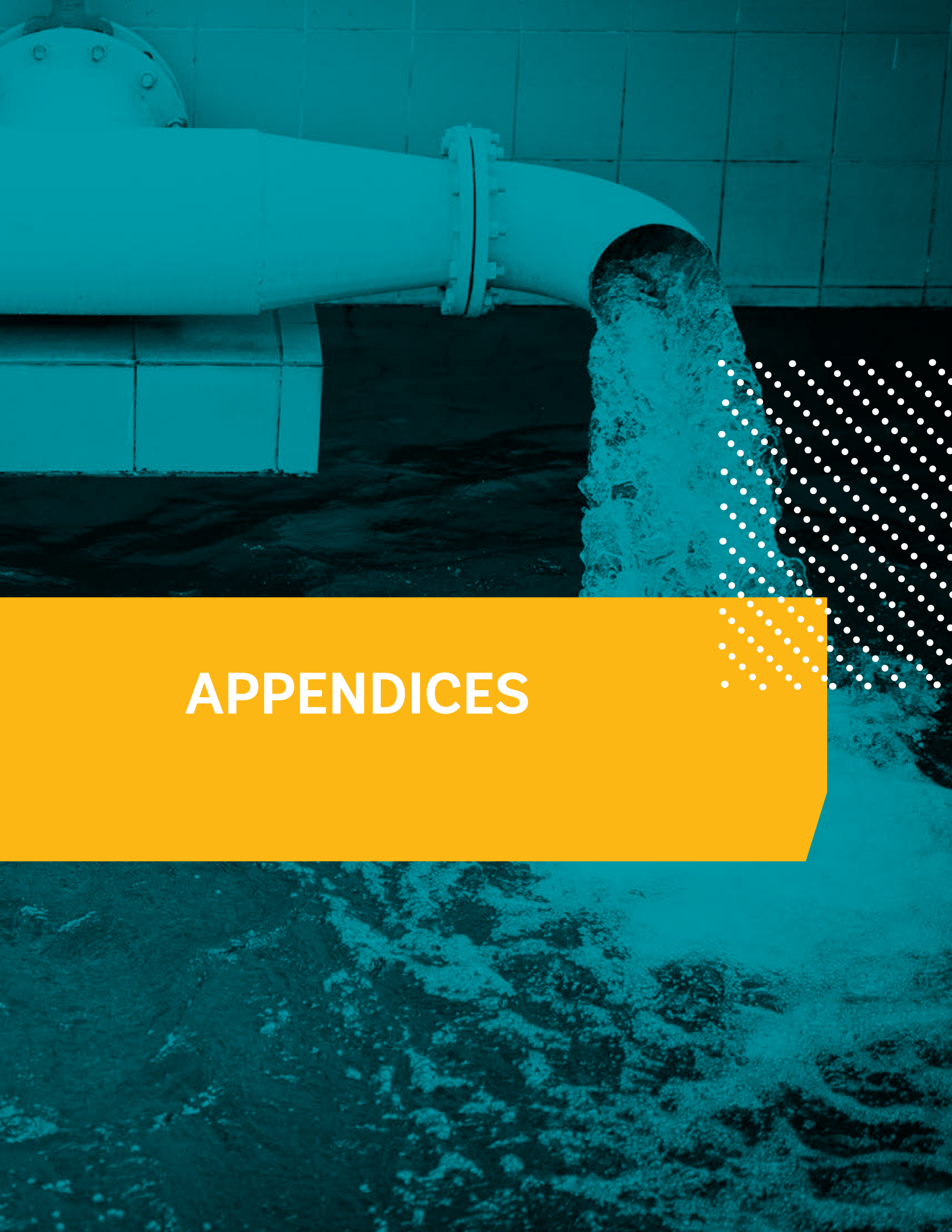
TARIFF & COST (HO CHI MINH CITY)	
Water Tariff (US$/$m^3$)	0.24
Water Tariff, PPP-Adjusted	0.61
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.23
Operational Cost Coverage Ratio	1.55
Operational Expenditure, Water and Wastewater (US$/$m^3$)	0.24

QUALITY	
Non-Revenue Water (%)	23.79
Water Quality (% passing chlorine test)	95.95

ACCESS	
Piped Sewerage, Urban (%)	1.73
Piped Sewerage, Rural (%)	<1.0
Piped Sewerage, Total (%)	<1.0

TARIFF & COST (HO CHI MINH CITY)	
Wastewater Tariff (US$/$m^3$)	0.02
Wastewater Tariff, PPP-Adjusted (US$/$m^3$)	0.06
Operational Expenditure, Wastewater (US$/population served)	4.07

QUALITY	
Wastewater Treatment (%)	10.0
Wastewater Connection (%)	2.0



APPENDICES

Appendix 1: Infrastructure Data by Sector and Dimension

ELECTRICITY ACCESS

GROUP	COUNTRY	ACCESS TO ELECTRICITY (% OF POPULATION)		
		TOTAL	RURAL	URBAN
EAP High Income	Brunei Darussalam	100.00	100.00	100.00
	Japan	100.00	100.00	100.00
	Korea	100.00	100.00	100.00
	New Zealand	100.00	100.00	100.00
	Singapore	100.00	100.00	100.00
East Asia	Cambodia	89.07	86.09	99.06
	China	100.00	99.97	100.00
	Indonesia	98.14	95.66	100.00
	Lao PDR	93.60	90.51	99.50
	Malaysia	100.00	100.00	100.00
	Mongolia	85.87	55.74	99.82
	Myanmar	69.81	59.92	92.55
	Philippines	93.00	90.02	96.40
	Thailand	100.00	100.00	100.00
	Timor-Leste	80.38	71.89	100.00
	Vietnam	100.00	100.00	100.00
Pacific Islands	Fiji	96.00	91.06	99.92
	Papua New Guinea	54.43	50.42	81.03
	Samoa	96.80	96.08	100.00
	Solomon Islands	62.90	59.59	73.77
	Vanuatu	62.78	52.74	92.67
South Asia	Afghanistan	97.70	97.09	99.50
	Bangladesh	88.00	81.28	99.50
	Bhutan	97.70	96.76	99.10
	India	92.62	89.31	99.21
	Maldives	99.80	99.86	99.70
	Nepal	95.51	94.74	98.69
	Pakistan	70.79	54.14	100.00
	Sri Lanka	97.54	96.99	100.00

Source: Sustainable Energy for All (SE4ALL) database, 2020 (using 2017 data). World Bank, International Energy Agency, and the Energy Sector Management Assistance Program.

ELECTRICITY QUALITY

GROUP	COUNTRY	TRANSMISSION & DISTRIBUTION LOSS (% OF OUTPUT)	QUALITY OF SUPPLY (1-7, WORST TO BEST)	AVERAGE TIME TO CONNECT (DAYS)
EAP High Income	Brunei Darussalam	6.41	5.4	25
	Japan	4.31	6.7	81
	Korea	3.35	6.4	13
	New Zealand	6.54	6.5	58
	Singapore	2.03	6.9	26
East Asia	Cambodia	23.42	3.5	179
	China	5.47	5	32
	Indonesia	9.40	4.4	32
	Lao PDR	12.28	4.8	87
	Malaysia	5.79	5.9	24
	Mongolia	14.75	4	79
	Myanmar	20.49	–	70
	Philippines	9.41	4.2	37
	Thailand	6.11	5.2	30
	Timor-Leste	–	–	93
	Vietnam	9.29	4.3	31
Pacific Islands	Fiji	–	–	81
	Papua New Guinea	–	–	66
	Samoa	–	–	34
	Solomon Islands	–	–	53
	Vanuatu	–	–	120
South Asia	Afghanistan	33.00	–	114
	Bangladesh	11.40	3.7	125
	Bhutan	–	5.8	61
	India	19.33	4.7	53
	Maldives	–	–	75
	Nepal	32.21	2.8	49
	Pakistan	17.14	2.9	113
	Sri Lanka	11.44	4	100

Sources: Electric Power Transmission & Distribution Loss: OECD/IEA, IEA Statistics, 2018 (using 2014 data); Quality of electricity supply: World Economic Forum, Global Competitiveness Index, 2017-2018; and Average time to connect: World Bank, Doing Business, 2019.

ELECTRICITY QUALITY

GROUP	COUNTRY	SYSTEM AVERAGE INTERRUPTION DURATION INDEX (AVERAGE HOURS PER CUSTOMER PER YEAR)	SYSTEM AVERAGE INTERRUPTION FREQUENCY INDEX (AVERAGE NUMBER OF INTERRUPTIONS PER CUSTOMER PER YEAR)
EAP High Income	Brunei Darussalam	0.4	0.3
	Japan (Tokyo)	0.0	0.0
	Korea	0.0	0.1
	New Zealand	3.8	2.1
	Singapore	0.1	0.1
East Asia	Cambodia	20.8	15.4
	China (Beijing)	0.8	0.2
	Indonesia (Jakarta)	2.6	2.2
	Lao PDR	4.0	22.7
	Malaysia	0.5	0.5
	Mongolia	62.0	15.0
	Myanmar	30.3	26.4
	Philippines	3.6	2.2
	Thailand	0.4	0.7
	Timor-Leste	-	-
	Vietnam	2.1	1.6
Pacific Islands	Fiji	5.0	4.7
	Papua New Guinea	940.0	500.0
	Samoa	35.9	15.8
	Solomon Islands	3.1	1.5
	Vanuatu	7.3	5.1
South Asia	Afghanistan	–	–
	Bangladesh	–	–
	Bhutan	7.1	2.9
	India (Delhi)	4.6	2.6
	Maldives	168.0	2.5
	Nepal	–	–
	Pakistan (Karachi)	99.0	90.0
	Sri Lanka	4.0	3.0

Note: System Average Interruption Duration is the average total duration of outages over the course of a year for each customer served, while System Average Interruption Frequency is the average number of service interruptions experienced by a customer in a year. SAIDI and SAIFI figures are national, except for city-level figures for China (Beijing), India (Delhi), Indonesia (Jakarta), Japan (Tokyo), and Pakistan (Karachi).

Source: World Bank, Doing Business (2019).

ELECTRICITY QUALITY

GROUP	COUNTRY	RENEWABLE ELECTRICITY GENERATION (% TOTAL ELECTRICITY OUTPUT)	TOTAL CO_2 EMISSIONS FROM ELECTRICITY AND HEAT PRODUCTION ($MTCO_2$)
EAP High Income	Brunei Darussalam	0.05	2.6
	Japan	15.98	554.9
	Korea	1.89	322.1
	New Zealand	80.08	5.1
	Singapore	1.82	20.7
East Asia	Cambodia	46.42	4.1
	China	26.00	4618.2
	Indonesia	10.65	195.9
	Lao PDR	81.00	–
	Malaysia	9.96	106.9
	Mongolia	7.00	12.8
	Myanmar	58.85	8.1
	Philippines	25.41	63.1
	Thailand	8.54	88.2
	Timor-Leste	0.00	–
	Vietnam	36.73	71.6
Pacific Islands	Fiji	45.02	–
	Papua New Guinea	34.53	–
	Samoa	30.35	–
	Solomon Islands	2.26	–
	Vanuatu	21.26	–
South Asia	Afghanistan	12.67	–
	Bangladesh	1.23	36.9
	Bhutan	99.99	-
	India	15.34	1100.4
	Maldives	1.28	–
	Nepal	100	0.0
	Pakistan	31.43	54.5
	Sri Lanka	48.48	9.9

Sources: Renewable electricity generation: All countries except Afghanistan, China, Lao PDR, and Mongolia: OECD/IEA, IEA Statistics, 2018 (using 2015 data); Afghanistan source: World Bank estimate, based on Da Afghanistan Breshna Sherkat data, 2020; China source: China Power Industry Statistics Express, 2019; Lao PDR source: Calculated by World Bank Energy Team based on the MEM consolidated power development projects, 2020; Mongolia source: World Bank Energy team estimate, 2019: CO_2 emissions: IEA Statistics, Total CO_2 Emissions from Electricity and Heat Production, 2019 (using 2017 data).

ELECTRICITY TARIFFS AND COSTS

GROUP	COUNTRY	AVERAGE ELECTRICITY TARIFF (US$/KWH)	AVERAGE OPERATIONAL COST OF ELECTRICITY GENERATION (US$/KWH)	LEVELIZED COST OF ELECTRICITY (US$/KWH)
EAP High Income	Brunei Darussalam	–	–	–
	Japan	0.25	0.05	0.08
	Korea	0.10	0.21	0.05
	New Zealand	–	–	–
	Singapore	0.16	0.12	–
East Asia	Cambodia	0.19	0.08	–
	China	0.10	0.05	0.04
	Indonesia	0.09	0.10	0.12
	Lao PDR	0.08	0.09	–
	Malaysia	0.10	0.06	0.11
	Mongolia	0.06	–	–
	Myanmar	0.06	0.07	–
	Philippines	0.17	–	0.12
	Thailand	0.11	0.04	0.08
	Timor-Leste	–	–	–
	Vietnam	0.08	–	0.17
Pacific Islands	Fiji	–	0.10	–
	Papua New Guinea	–	0.10-0.12	–
	Samoa	–	–	–
	Solomon Islands	0.89	0.26	–
	Vanuatu	0.61	–	–
South Asia	Afghanistan	0.10	0.03	–
	Bangladesh	0.08	0.07	–
	Bhutan	0.04	0.08	–
	India	0.09	–	0.09
	Maldives	0.31	0.30-0.40	–
	Nepal	0.09	0.01	–
	Pakistan	0.12	0.05	–
	Sri Lanka	0.14	0.12	–

Note: Average electricity tariff for all users (US$/KWh) based on $ revenue / total KWh consumed

Sources: Average electricity tariffs: RISE database, various years, except Bhutan, and Singapore, see Appendix 4;
Operational cost of electricity generation, various sources, see Appendix 5;
Levelized cost of energy calculated by authors based on inputs from Bloomberg New Energy Finance (2017) and Lazard (2016).

WATER SUPPLY ACCESS

GROUP	COUNTRY	PROPORTION OF POPULATION USING IMPROVED WATER, PIPED (% POPULATION)		
		TOTAL	RURAL	URBAN
EAP High Income	Brunei Darussalam	>99.0	>99.0	>99.0
	Japan	97.90	–	–
	Korea	98.79	–	–
	New Zealand	>99.0	>99.0	>99.0
	Singapore	>99.0	–	>99.0
East Asia	Cambodia	26.13	10.87	77.28
	China	76.06	53.77	92.22
	Indonesia	18.28	13.01	22.66
	Lao PDR	49.48	32.28	82.34
	Malaysia	94.54	81.20	98.88
	Mongolia	25.13	4.98	34.45
	Myanmar	24.55	10.50	56.85
	Philippines	40.12	34.26	46.81
	Thailand	70.29	54.33	86.77
	Timor-Leste	64.55	56.71	82.67
	Vietnam	42.87	22.14	81.00
Pacific Islands	Fiji	86.97	74.32	97.01
	Papua New Guinea	18.38	12.80	55.43
	Samoa	84.90	83.73	90.07
	Solomon Islands	46.24	38.88	70.50
	Vanuatu	47.62	37.25	78.47
South Asia	Afghanistan	21.67	13.76	45.10
	Bangladesh	14.90	2.50	37.08
	Bhutan	>99.0	>99.0	>99.0
	India	43.74	31.53	67.87
	Maldives	47.80	15.00	98.30
	Nepal	47.40	45.51	55.31
	Pakistan	28.37	15.25	51.26
	Sri Lanka	38.28	30.27	73.83

Note: This measure includes access to improved, piped water sources, sources, shared and on-premises.

Sources: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data).

WATER QUALITY

GROUP	COUNTRY	NON-REVENUE WATER (%)	QUALITY OF WATER SUPPLIED (% SAMPLES PASSING ON RESIDUAL CHLORINE)
EAP High Income	Brunei Darussalam	–	–
	Japan	2.74	–
	Korea	16.28	–
	New Zealand	23.41	n/a
	Singapore	5.00	100.00
East Asia	Cambodia	6.74	100.00
	China	20.54	99.60
	Indonesia	32.80	–
	Lao PDR	29.17	–
	Malaysia	34.40	–
	Mongolia	14.44	100.00
	Myanmar	–	–
	Philippines	25.33	–
	Thailand	–	–
	Timor-Leste	–	–
	Vietnam	23.79	95.95
Pacific Islands	Fiji	45.06	95.11
	Papua New Guinea	55.55	99.98
	Samoa	50.84	98.84
	Solomon Islands	59.93	75.23
	Vanuatu	32.28	100.00
South Asia	Afghanistan	41.24	-
	Bangladesh	21.56	98.71
	Bhutan	33.96	100.00
	India	32.90	81.70
	Maldives	–	–
	Nepal	36.30	86.84
	Pakistan	44.00	100.00
	Sri Lanka	24.90	–

Note: For Bhutan, China, India, "Quality of water supplied" refers to the percentage of water samples that meet or exceed the specified potable water standards. For all other countries, this indicator measures the proportion of samples passing residual chlorine tests. For Philippines, the NRW rate is an average of rates across Manila and Davao. For Singapore, the NRW value refers to Singapore's reported rate of 'Unaccounted-for Water'.

Sources: Various sources and coverage at national or municipal levels, see Appendix 7.

WATER TARIFFS

GROUP	COUNTRY (MUNICIPALITY)	TARIFF (US$ PER M^3)	TARIFF (PPP-ADJUSTED US$ PER M^3)
EAP High Income	Brunei Darussalam (Bandar Seri Begawan)	0.08	0.14
	Japan (Tokyo)	1.03	1.08
	Korea (Seoul)	0.53	0.60
	New Zealand (Auckland)	1.09	0.94
	Singapore (Singapore)	1.25	1.46
East Asia	Cambodia (Phnom Penh)	0.15	0.38
	China (Shanghai)	0.28	0.50
	Indonesia (Jakarta)	0.46	1.23
	Lao PDR (Vientiane)	0.19	0.49
	Malaysia (Kuala Lumpur)	0.13	0.34
	Mongolia (Ulaanbaatar)	0.33	0.91
	Myanmar (Yangon)	0.02	0.10
	Philippines (Manila)	0.71	1.80
	Thailand (Bangkok)	0.25	0.66
	Timor-Leste (Dili)	–	–
	Vietnam (Ho Chi Minh City)	0.24	0.61
Pacific Islands	Fiji (Suva)	0.08	0.12
	Papua New Guinea (Port Moresby)	0.43	0.51
	Samoa (Apia)	0.30	0.46
	Solomon Islands (Guadalcanal Province)	0.75	0.75
	Vanuatu (Port Vila)	0.61	0.63
South Asia	Afghanistan (Kabul)	0.34	1.27
	Bangladesh (Dhaka)	0.12	0.29
	Bhutan (Thimphu City)	0.04	0.11
	India (Mumbai)	0.19	0.61
	Maldives (Male)	3.87	5.80
	Nepal (Kathmandu)	0.17	0.47
	Pakistan (Karachi)	0.08	0.27
	Sri Lanka (Colombo)	0.09	0.26

Note: Water tariffs recorded are for the household tariff block associated with the first 15 m^3 consumed in a month.

Source: Various sources, see Appendix 6.

WATER COSTS

GROUP	COUNTRY	OPERATIONAL EXPENDITURE, WATER & WASTEWATER (US$/M³ WATER SOLD)	OPERATIONAL EXPENDITURE, WATER (US$/M³ WATER SOLD)	OPERATIONAL COST COVERAGE RATIO
EAP High Income	Brunei Darussalam	–	–	–
	Japan	–	1.58	–
	Korea	0.97	0.61	2.48
	New Zealand	0.69	0.69	2.43
	Singapore	–	1.13	1.22
East Asia	Cambodia	0.12	0.12	2.57
	China	0.43	0.41	0.76
	Indonesia	–	–	1.05
	Lao PDR	0.33	–	0.87
	Malaysia	–	–	1.15
	Mongolia	0.56	0.36	0.84
	Myanmar	–	–	-
	Philippines	–	–	1.20
	Thailand	0.18	–	0.62
	Timor-Leste	–	–	–
	Vietnam	0.24	0.23	1.55
Pacific Islands	Fiji	0.80	0.75	0.81
	Papua New Guinea	1.06	0.90	1.64
	Samoa	0.67	-	1.27
	Solomon Islands	2.61	2.08	1.37
	Vanuatu	0.59	0.59	1.28
South Asia	Afghanistan	0.16	-	1.01
	Bangladesh	0.14	0.11	1.33
	Bhutan	–	–	1.75
	India	–	–	0.39
	Maldives	–	-	–
	Nepal	0.17	0.17	1.18
	Pakistan	0.15	–	0.43
	Sri Lanka	–	0.13	0.90

Note: Unit Operational Expenditure, Water & WW (US$/m³ water sold) = total annual operational expenses / total volume of water sold, and Unit Operational Expenditure, Water (US$/m³ water sold) = annual water service operational expenses / total volume of water sold. Operational cost coverage is the ratio of total annual operational revenues to total annual operational expenditures.

Source: Various sources, see Appendix 7.

SANITATION ACCESS

GROUP	COUNTRY (MUNICIPALITY)	PROPORTION OF POPULATION USING IMPROVED SANITATION FACILITIES (INCLUDING SHARED) WITH PIPED SEWER CONNECTION (%)		
		TOTAL	RURAL	URBAN
EAP High Income	Brunei Darussalam	95.29	95.60	95.20
	Japan	76.45	–	–
	Korea	>99.0	–	–
	New Zealand	83.76	–	–
	Singapore	>99.0	–	>99.0
East Asia	Cambodia	14.32	3.43	50.83
	China	62.18	38.50	79.36
	Indonesia	11.34	13.53	9.52
	Lao PDR	1.11	<1.0	1.94
	Malaysia	79.18	-	-
	Mongolia	21.09	3.11	29.41
	Myanmar	<1.0	<1.0	<1.0
	Philippines	4.29	3.04	5.72
	Thailand	8.61	5.41	11.91
	Timor-Leste	11.30	8.33	18.15
	Vietnam	<1.0	<1.0	1.73
Pacific Islands	Fiji	–	–	–
	Papua New Guinea	3.92	1.00	23.30
	Samoa	<1.0	<1.0	<1.0
	Solomon Islands	6.87	1.98	22.96
	Vanuatu	12.07	11.01	15.23
South Asia	Afghanistan	2.60	<1.0	8.14
	Bangladesh	5.24	<1.0	14.36
	Bhutan	5.63	1.15	12.30
	India	10.56	<1.0	29.55
	Maldives	60.13	34.24	>99
	Nepal	5.13	1.75	19.22
	Pakistan	25.23	5.37	59.87
	Sri Lanka	4.19	2.30	12.59

Source: WHO / UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2019 (using 2017 data), except Brunei (2016 data).

SANITATION ACCESS

GROUP	COUNTRY	PROPORTION OF POPULATION USING IMPROVED SANITATION FACILITIES (INCLUDING SHARED) (%)		
		TOTAL	RURAL	URBAN
EAP High Income	Brunei Darussalam	96.33	97.34	96.03
	Japan	>99.0	>99.0	>99.0
	Korea	>99.0	>99.0	>99.0
	New Zealand	>99.0	>99.0	>99.0
	Singapore	>99.0	>99.0	>99.0
East Asia	Cambodia	65.70	55.46	>99.0
	China	90.74	81.96	97.11
	Indonesia	85.37	76.76	92.52
	Lao PDR	77.24	66.35	98.03
	Malaysia	>99.0	>99.0	>99.0
	Mongolia	86.48	65.13	96.36
	Myanmar	73.69	67.62	87.62
	Philippines	91.42	88.25	95.04
	Thailand	>99.0	>99.0	>99.0
	Timor-Leste	62.60	50.32	90.95
	Vietnam	87.28	82.07	96.86
Pacific Islands	Fiji	>99.0	>99.0	>99.0
	Papua New Guinea	15.21	9.14	55.52
	Samoa	98.00	98.00	98.00
	Solomon Islands	39.13	21.97	95.64
	Vanuatu	68.61	60.88	91.60
South Asia	Afghanistan	53.24	42.97	83.65
	Bangladesh	70.88	64.40	82.46
	Bhutan	78.30	72.14	87.48
	India	72.05	61.11	93.66
	Maldives	>99.0	>99.0	>99.0
	Nepal	75.74	71.92	91.69
	Pakistan	70.05	62.92	82.49
	Sri Lanka	98.85	>99.0	97.08

Note: Access to improved sanitation includes access to improved sanitation facilities (including shared) such as latrines and household or shared toilets connected to septic tanks or sewer connections.

Source: WHO/UNICEF Joint Monitoring Programme, 2019 (using 2017 data).

SANITATION QUALITY

GROUP	COUNTRY	WASTEWATER TREATMENT RATE (% TREATED)	WASTEWATER CONNECTION RATE (% OF HOUSEHOLDS CONNECTED)
EAP High Income	Brunei Darussalam	–	44.0
	Japan	75.8	76.3
	Korea	92.1	92.1
	New Zealand	82.0	85.6
	Singapore	100.0	100.0
East Asia	Cambodia	<1.0	10.0
	China	<1.0	56.0
	Indonesia	1.0	2.5
	Lao PDR	<1.0	<1.0
	Malaysia	61.6	31.8
	Mongolia	10.0	33.0
	Myanmar	<1.0	<1.0
	Philippines	63.0	4.1
	Thailand	<1.0	<1.0
	Timor-Leste	5.0	6.0
	Vietnam	10.0	2.0
Pacific Islands	Fiji	10.0	39.0
	Papua New Guinea	<1.0	10.0
	Samoa	–	–
	Solomon Islands	<1.0	30.0
	Vanuatu	–	–
South Asia	Afghanistan	<1.0	8.0
	Bangladesh	<1.0	2.0
	Bhutan	<1.0	10.0
	India	19.2	11.7
	Maldives	–	<1.0
	Nepal	<1.0	10.0
	Pakistan	1.0	10.0
	Sri Lanka	<1.0	2.5

Notes: Wastewater treatment rate measures the percentage of collected wastewater treated; wastewater connection rate measures the percentage connected to wastewater treatment.

Source: Yale University Environmental Performance Index (EPI), 2018 (using 2015 data).

SANITATION TARIFFS

GROUP	COUNTRY (MUNICIPALITY)	WASTEWATER TARIFF (US$ PER M³)	PPP-ADJUSTED WASTEWATER TARIFF (US$ PER M³)
EAP High Income	Brunei Darussalam (Bandar Seri Begawan)	–	–
	Japan (Tokyo)	0.85	0.89
	Korea (Seoul)	0.29	0.33
	New Zealand (Auckland)	2.32	1.93
	Singapore (Singapore)	0.61	0.71
East Asia	Cambodia (Phnom Penh)	0.02	0.02
	China (Shanghai)	0.23	0.40
	Indonesia (Jakarta)	–	–
	Lao PDR (Vientiane)	–	–
	Malaysia (Kuala Lumpur)	0.05	0.12
	Mongolia (Ulaanbaatar)	0.17	0.48
	Myanmar (Yangon)	–	–
	Philippines (Manila)	–	–
	Thailand (Bangkok)	–	–
	Timor-Leste (Dili)	–	–
	Vietnam (Ho Chi Minh City)	0.02	0.06
Pacific Islands	Fiji (Suva)	0.10	0.16
	Papua New Guinea (Port Moresby)	0.20	0.24
	Samoa (Apia)	1.38	1.88
	Solomon Islands (Guadalcanal Province)	0.35	0.35
	Vanuatu (Port Vila)	–	–
South Asia	Afghanistan (Kabul)	–	–
	Bangladesh (Dhaka)	0.12	0.29
	Bhutan (Thimphu City)	–	–
	India (Mumbai)	0.05	0.17
	Maldives (Male)	–	–
	Nepal (Kathmandu)	0.08	0.24
	Pakistan (Karachi)	0.01	0.03
	Sri Lanka (Colombo)	0.11	0.33

Source: Various sources, see Appendix 6.

SANITATION COSTS

GROUP	COUNTRY	OPERATIONAL EXPENDITURE, WASTEWATER (US$/POPULATION SERVED)
EAP High Income	Brunei Darussalam	–
	Japan	–
	Korea	38.91
	New Zealand	78.37
	Singapore	–
East Asia	Cambodia	–
	China	–
	Indonesia	–
	Lao PDR	–
	Malaysia	–
	Mongolia	9.24
	Myanmar	–
	Philippines	–
	Thailand	–
	Timor-Leste	–
	Vietnam	4.07
Pacific Islands	Fiji	33.07
	Papua New Guinea	33.22
	Samoa	–
	Solomon Islands	503.2
	Vanuatu	–
South Asia	Afghanistan	–
	Bangladesh	4.67
	Bhutan	–
	India	
	Maldives	–
	Nepal	–
	Pakistan	2.79
	Sri Lanka	–

Note: Operational Expenditure, Wastewater (US$/population served) = annual operational wastewater expenses / population served.

Source: Various sources, see Appendix 7.

ROAD TRANSPORT ACCESS

GROUP	COUNTRY	RURAL ROAD ACCESS INDEX	RURAL POPULATION DENSITY (POPULATION PER km²)
EAP High Income	Brunei Darussalam	–	–
	Japan	93.30	0.02
	Korea	90.88	0.01
	New Zealand	85.07	1.85
	Singapore	–	–
East Asia	Cambodia	38.09	68.06
	China	57.37	69.51
	Indonesia	47.92	787.58
	Lao PDR	31.46	24.27
	Malaysia	50.13	106.66
	Mongolia	18.87	6.90
	Myanmar	38.34	60.12
	Philippines	64.09	198.91
	Thailand	46.06	78.90
	Timor-Leste	46.08	71.64
	Vietnam	66.68	197.71
Pacific Islands	Fiji	–	–
	Papua New Guinea	11.72	134.02
	Samoa	31.62	57.58
	Solomon Islands	9.30	135.49
	Vanuatu	–	–
South Asia	Afghanistan	20.31	0.12
	Bangladesh	47.03	856.32
	Bhutan	34.19	16.04
	India	42.80	2857.23
	Maldives	6.52	880.81
	Nepal	51.65	135.19
	Pakistan	39.89	1238.31
	Sri Lanka	68.72	340.20

Source: Mikou, et al, 2019, based on World Bank RAI methodology by Roberts et al, 2006.

ROAD TRANSPORT QUALITY

GROUP	COUNTRY	QUALITY OF ROAD INFRASTRUCTURE (1–7, FROM WORST TO BEST)	ESTIMATED ROAD TRAFFIC DEATH RATE (PER 100,000 POPULATION)	TOTAL CO_2 EMISSIONS FROM ROAD TRANSPORT ($MTCO_2$)
EAP High Income	Brunei Darussalam	4.9	–	1.3
	Japan	6.0	4.1	184.2
	Korea	5.7	9.8	97.9
	New Zealand	4.7	7.8	14.3
	Singapore	6.4	2.8	6.7
East Asia	Cambodia	3.3	17.8	4.5
	China	4.6	18.2	726.3
	Indonesia	3.9	12.2	124.5
	Lao PDR	3.2	16.6	-
	Malaysia	5.5	23.6	58.9
	Mongolia	3.1	16.5	1.4
	Myanmar	–	19.9	4.3
	Philippines	3.5	12.3	30.0
	Thailand	4.4	32.7	71.6
	Timor-Leste	–	12.7	-
	Vietnam	3.2	26.4	35.8
Pacific Islands	Fiji	–	9.6	–
	Papua New Guinea	–	14.2	–
	Samoa	–	11.3	–
	Solomon Islands	–	17.4	–
	Vanuatu	–	15.9	–
South Asia	Afghanistan	–	15.1	–
	Bangladesh	3.1	15.3	8.4
	Bhutan	–	17.4	–
	India	4.4	22.6	265.7
	Maldives	–	0.9	–
	Nepal	2.6	15.9	4.8
	Pakistan	3.9	14.3	52.6
	Sri Lanka	3.8	14.9	10.6

Sources: Quality of Road Infrastructure: World Economic Forum, Global Competitiveness Report, 2018;
Road traffic death rate: WHO Global Health Repository, 2019 (using 2016 data);
CO_2 emissions from road transport: IEA Statistics, Total CO_2 Emissions from Road Transport, 2019 (using 2017 data).

Appendix 2: Methodology and Sources

Infrastructure can refer to a wide array of services, including assets that accommodate social services, such as schools, hospitals, and housing developments, as well as economic infrastructure assets that facilitate trade and production, including energy, water, and transport. This report focuses on the provision of three key economic infrastructure sectors: road transport; water and sewerage; and electricity.

Geographically, this report assesses the status of infrastructure services in four sub-regions. High-income regional benchmark countries are Brunei Darussalam, Japan, New Zealand, Singapore, and Korea. These benchmark countries were selected as points of comparison due to their higher levels of income and proximity to the EAP/SAR countries being studied. Emerging East Asian countries included in the study are Cambodia, China, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, the Philippines, Thailand, Timor-Leste, and Vietnam. South Asian countries are Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka. Lastly, the Pacific Islands countries included in this study are Fiji, Papua New Guinea, Samoa, the Solomon Islands, and Vanuatu. The Pacific Islands sample includes countries in which The World Bank Group has operational presences; however, because of significant data insufficiencies, some states were not included.

The status of infrastructure in EAP is assessed based on three aspects—access, quality, and tariffs and costs. Data sources and indicators used for each section are detailed in the remaining appendices. Descriptive statistical analyses are given at the regional and national levels.

Data Sources and Challenges

Data was sourced from a wide variety of sources, including public data sets; subscription data sets produced by industry and market-research companies; and government, industry, and company utility reports. These include statistical and geospatial data drawn from the World Bank; the Asian Development Bank; ASEAN; the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP); U.S. National Aeronautics and Space Administration (NASA) and country data sets; market intelligence for the energy and water sectors; and open-access map data. Data on access to electricity services and water supply was the most readily available. Data for road-transport access required geospatial modeling and advanced computational techniques to estimate the degree of access to paved rural roads, based on open road-map data and population data. Data sources are described in further detail in Appendices 4, 5, 6, and 7.

Compiling data for tariffs and costs of service required drawing information from numerous sources. In some cases, data sets covered a number of countries, but with varying degrees of generalizability to the national level. To make these variations explicit, the coverage of data sources for electricity and water and wastewater tariffs and costs is described in detail in Appendices 4, 5, 6, and 7.

Although data was available, at least partially, on operational expenditures for electricity and water and sanitation, data on capital expenditures was grossly insufficient. No readily comparable data sets exist to capture these kinds of costs across countries. Moreover, capital expenditures are often not publicly and consistently reported in financial reports or by governments. Similarly, data on road costs at the national level was unavailable, and estimations of comparable per-kilometer road construction costs are difficult to make, due to high degrees of variance in road quality, width, materials, and terrain.

ACCESS DATA

This study uses multiple databases to source access data for electricity, water, and sanitation. Road access data was generated using geospatial models. The following set of indicators was used to evaluate access of the population to essential infrastructure services:

SECTOR	INDICATOR	UNIT OF MEASURE	EXPLANATION
Electricity	Access to electricity (total, rural, urban)	% of total population	Percentage of population (total, rural, urban) with access to household electricity service.
Water	Access to piped water on premises (total, rural, urban)	% of total population	Percentage of population (total, rural, urban) with access to an improved water source via piped water on premises.
Sanitation	Access to sewerage connection on premises (total, rural, urban)	% of total population	Percentage of population (total, rural, urban) with access to piped household sewer connection.
	Access to improved sanitation (Total, Rural, Urban)	% of total population	Percentage of population (total, rural, urban) with access to either household or shared improved sanitation.
Road Transport	Rural Access Index (RAI)	%	Percentage of rural population with access (within two kilometers) to all-season roads.

Electricity access data was drawn from the World Bank Development Indicator database 2016 update. The access data draws on country-level reporting to provide the share of the total, urban and rural populations with access to electricity services. Electrification data are collected from industry, national surveys, and international sources, and are maintained in the World Bank's Sustainable Energy for All (SE4ALL) database.

Data for water and sanitation access are drawn from the 2017 update to the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, which collects and publishes an extensive and comprehensive global dataset on access to water and sanitation. The JMP database collects data about access to improved water and sanitation facilities, and the share of total, urban and rural populations with access.

Definitions of "access to an improved sanitation facility" capture services that are broader than those particular to networked infrastructure systems. They include, for example, households with a well, septic tank, or other non-grid-based access as quality infrastructure. To further narrow the definitions to more accurately reflect the state of infrastructure, this study also uses data from two JMP sub-indicators ("access to an improved water source, piped on premise" and "access to improved sanitation facility, to piped sewer system") to consider household, grid-based access to water supply and sewerage infrastructure.

The Rural Access Index (RAI) indicators reported are drawn from work by Mikou, et al (2019). The RAI, as defined by Roberts, et al (2006), measures the proportion of the rural population with access to all-season roads within a walking distance of two kilometers (typically about 20 to 25 minutes' walk). All-season roads should be accessible throughout the year, regardless of seasonality or weather events such as intensive rainfall. Estimating the RAI with geospatial data requires two kinds of information: the road network and population data. Mikou, et al, generate updated RAI calculations based on data from open-access sources rather than household surveys.

Mikou, et al, utilize Open Street Map (OSM) road networks to consider road networks in each country. Because OSM does not contain information on road quality, however, published road classification information is taken into account to make assumptions about road seasonality. The "all-seasonality" of roads is based on the surface type and roughness of each road. The RAI calculations take into account paved roads in good and fair condition

and unpaved roads in good condition as proxies of all-season roads. Because this data is not necessarily available for OSM across countries, however, the authors classify roads in OSM in four categories: primary, secondary, tertiary, and tracks. The authors calculate the RAI under the assumption that all-season roads are either: (i) primary and secondary roads only; (ii) primary, secondary and tertiary roads; and (iii) all roads. They then compare results to previous RAI estimates as well as the fraction of paved roads provided by the International Roads Federation and conclude that the best proxies for all-season roads are primary and secondary roads.

The RAI is then calculated by overlaying the roads with the population layer, drawing a buffer around the roads, and counting the number of people in the buffer (World Bank, 2016a). To estimate the populations surrounding particular road segments, the authors utilize the WorldPop data set, which provides geocoded population density data, and is considered the most accurate and robust population-density data set available. The authors additionally utilize the Global Rural-Urban Mapping Project (GRUMP) dataset for urban-rural delimitation.

The authors note several limitations to their approach. For one, WorldPop uses roads as a factor to model population distribution, so endogeneity in the analysis could lead to overestimation of rural access. Moreover, the "all-seasonality" of road segments must be assumed based on available data, particularly because many low-income countries lack updated road-network data. OSM classifies roads based on function but does not provide full information on road quality. In the analysis, the authors classify roads in OSM in four categories (primary, secondary, tertiary, and tracks) and calculate the RAI assuming that all-season roads include primary and secondary roads.

Rural population density captures the average population per square kilometer in rural areas of each country. Calculations use GRUMP data for rural land area for all countries, except the Maldives.[8] WorldPop is used to source 2015 rural population data for all countries except the Maldives and New Zealand. For the latter countries, rural population is calculated using the percentage of population that is rural, and the total population of the country, drawing on 2015 World Bank data.

First the GRUMP data was converted to geographic information system (GIS) format-vector data. The GRUMP dataset is in raster format, consisting of a matrix of cells (pixels) of urban extents (which could include rural areas). The raster format was converted to polygon format using the "Raster to Polygon" tool. Thereafter, rural areas could be extracted by using the "Select" tool. To compute the rural areas for each country, country-boundary data in the GIS format was used along with the "Clip" tool to isolate rural regions. The areas were then calculated using the "Calculate Geometry" tool.

The WorldPop data set was then used to compute the total rural population for each country. The WorldPop dataset is in raster format, consisting of a matrix of cells (pixels) with estimated populations. By overlaying each country's rural area, the sum of the raster values was calculated using the "Zonal Statistics by Table" tool. The rural population density was then calculated by dividing the rural population by the rural land area. The unit is population per square kilometer.

8 Maldives' rural land area (1995) is retrieved from World Bank data, https://data.worldbank.org/indicator/AG.LND.TOTL.RU.K2?end=2010&locations=MV&start=1990&view=chart)

QUALITY DATA

Data on the quality of services captures measures of reliability and efficiency of infrastructure services and, in some cases, the quality of the outputs (e.g., water quality). The following indicators were selected for the purposes of evaluating the quality:

SECTOR	INDICATOR	UNIT OF MEASURE	EXPLANATION
Electricity	Transmission & distribution losses	%	Amount of electricity produced that is lost during transmission and distribution.
	Quality of electricity Supply	Score (1-7, worst to best)	Perceptions of overall electricity supply.
	Time to Connect	Days	Average time to connect businesses to electricity services.
	Electric-power transmission and distribution losses	% of total output	Electric power transmission and distribution losses as a percentage of output to the transmission-and-distribution system.
	System Average Interruption Frequency Index (SAIFI)	# of interruptions per year	Average frequency (occurrence) of annual interruptions to electricity services.
	System Average Interruption Duration Index (SAIDI)	Average days per interruption	Average duration of interruptions to service.
	Share of renewables	%	Percentage of domestic electricity production from renewable energy sources.
Water	Non-revenue water	%	Percentage of water that enters the piped distribution for which revenues are not collected, due to leakages, theft, non-metering, or non-collection; represents the amount of water "lost" in the supply system.
	Water quality	%	Percentage of samples passing the residual chlorine test, which indicates whether sufficient chlorine remains in the water supply after distribution, to prevent microbial contamination during transport.
	Water service continuity	# of hours per day	Average daily hours of water service.
Sanitation	Wastewater treatment rate	%	Percentage of collected wastewater that is treated.
	Wastewater connection rate	%	Percentage of households connected to a wastewater-treatment facility.
Road Transport	Quality of road infrastructure	Score (1-7, worst to best)	Perceptions of overall road quality.
	Annual road-traffic death rate	# per 100,000 people per year	Number of road-traffic deaths per 100,000 population per year.

Data on quality of infrastructure services suffers from some general limitations. First, because it is aggregated at the country level, data does not capture within-country variations, which can be significant. Furthermore, publicly available data on service-quality issues is largely focused on urban areas and each country's largest cities. Therefore, although the indicators used in this chapter reflect the latest available information on the selected aspects of infrastructure quality in each country, they do not provide granularity with respect to levels of quality at the subnational level, which may vary significantly. Lastly, the quality of road infrastructure and electricity services is survey-based and subject to sampling limitations.

Electricity infrastructure quality is captured using several indicators. Electric-power transmission and distribution (T&D) losses are technical and non-technical losses that are not observed by households. Electric-power transmission and distribution losses include losses in transmission between sources of supply and points of distribution, and in the distribution to consumers, including pilferage. Thus, although not a measure of loss perceived by consumers, it is an important indicator of efficiency within the electricity-distribution system. The data was drawn from the World Development Indicators, which use information collected by the International Energy Agency (IEA), which in turn is drawn from national energy agencies.

The System Average Interruption Frequency Index (SAIFI) measures the number of interruptions per customer per year. It is calculated as a ratio between the number of customer interruptions and the number of total customers served, measured over the course of a year. Similarly, the System Average Interruption Duration Index (SAIDI) estimates the average length of service interruptions. SAIFI and SAIDI data are drawn from the World Bank Doing Business report, which sources information from national regulators for the largest business city in each economy. There are some limitations with respect to representativeness of the data, because the indicators cover only the main business city in each economy (as well as the second-biggest city for countries with more than 100 million residents).

Data regarding the quality of water-infrastructure services comes primarily from the International Benchmarking Network (IBNET) database. IBNET is the world's largest database for water and sanitation utilities' performance, gathering data for more than 4,000 water utilities in 130 countries. For most countries in the EAP region, the utilities covered by the database account for approximately 75 percent (or more) of each country's urban-service coverage. Although IBNET is one of the most comprehensive utility data sources available for water costs and quality, some data is outdated. In particular, IBNET data for Indonesia (2004), Malaysia (2007), Singapore (2008), and the Philippines (2009) required additional research to bring observations up to date (see Appendix 7). It is also important to note that the representativeness of IBNET data at the country level is low in China (3 percent). Moreover, all data in the IBNET database is self-reported by the participating utilities. These conditions must be acknowledged in the interpretation of comparative results.

With respect to water quality, non-revenue water (NRW) is a measure of the efficiency and technical health of the distribution network. NRW represents the water that has been produced by the utility but is "lost" before it reaches the customer, typically due to leakage; theft through illegal connections; or unmetered legal connections. A second indicator—the percentage of water samples that pass a residual-chlorine test—is a proxy for the cleanliness of supplied water with respect to microbial contamination. Residual chlorine is the low level of chlorine that remains in water after the chemical is applied to decontaminate and safeguard water against future microbial contamination during transportation to households. Data on NRW and water quality are also sourced from IBNET. Lastly, water-service continuity measures the average number of hours per day that a piped water system is reliably supplying water to customers.

Sanitation quality is proxied by measures of overall system hygiene (an indicator of waste management and

wastewater-treatment quality) and wastewater treatment. First, the diarrheal disability-adjusted life years (DALY) per 100,000 people accounts for years of life lost (due to disability or early death) because of diarrhea. One DALY can be thought of as one lost year of "healthy" life. Therefore, a low DALY count reflects safe water, sanitation, and hygiene conditions in the country. Data is drawn from WHO Global Health Estimates. The diarrheal DALY does not solely capture the prevalence of the disease caused by poor sanitation access or quality; it may also be affected by cultural or behavioral norms. Nevertheless, the indicator reflects the severity of problems associated with the presence of human waste in the water supply and in the built environment that lead to diarrheal incidences.

Second, the report assesses levels of wastewater treatment, drawing on Yale University's 2018 Environmental Performance Index report. The wastewater-treatment rate captures the percentage of wastewater collected that receives treatment, and the wastewater connection rate captures the percentage of households connected to a wastewater-treatment system. The variables capture five-year averages for each country. The original values used to calculate these variables are collected from a variety of sources, including country-level statistics; OECD data; UN Statistics Division data; secondary treatment levels from the Pinsent Masons Water Yearbook; and FAO-AQUASTAT values. This variety of sources may limit comparability across countries.

With respect to road-transport quality, the World Economic Forum's Global Competitiveness Report (2018) provides national-level perceptions data on the quality of road infrastructure, with measurement from 1 to 7 (worst to best). Data was collected via an extensive survey of industry experts, who were asked, "In your country, how is the quality (extensiveness and condition) of road infrastructure?" Additionally, some information to provide context is available from the UN Economic and Social Commission for Asia (UNESCAP) Asian Highway Database, which records country-reported assessments of the quality of Asian Highway Network (AHN) roads as "good," "fair," or "poor," as well as from the ASEAN-Japan Transport Partnership, which records the percentage of paved roads of the overall road network of ASEAN states. This data is self-reported annually by member states.

TARIFF AND COST DATA

Despite data limitations, this report presents information at the national and municipal levels on tariffs, costs of production, and rates of cost recovery.

SECTOR	INDICATOR	UNIT OF MEASURE	EXPLANATION
Electricity	Average electricity tariff	2016 US$/kWh	The average retail electricity tariff across all tariff blocks and consumer types, calculated as total collected revenues divided by total kWh sold.
	Operational cost of generating electricity	2017 US$/kWh	Average operational cost of generating electricity.
	Levelized cost of energy	2016 US$/kWh	Unit cost of producing 1 kWh, calculated using data from the energy mix for each country by source of production (e.g., solar, hydro-electric, coal, etc.) and the unitary costs of electricity production for each type of input.
Water	Water tariff for consumption block of 15m3, largest city	2016 US$/$m^3$	Water tariff for a block of monthly consumption of 15m^3 for the largest city in the country.
	PPP-adjusted water tariff for consumption block of 15m^3, largest city	2016 US$/$m^3$, adjusted for PPP	Water tariff for a block of monthly consumption of 15m^3 for the largest city in the country, adjusted for purchasing power parity (PPP).
	Operating expenditure coverage ratio	Ratio score	Water utilities' operating expenditure coverage ratio represents the extent to which a utility's revenues cover its basic operating and maintenance costs. It is a measure of total annual operational revenues divided by total annual operating expenditure.
	Operating expenditure, combined water and wastewater	US$/$m^3$ (various years)	Operating costs of producing and distributing water and, where applicable, collecting and treating wastewater.
Road Transport	Wastewater tariff	2016 US$/$m^3$	Wastewater collection and treatment tariff for a block of monthly consumption of 15m^3 for the largest city in the country, adjusted for purchasing power parity.

For the electricity sector, data on residential tariffs and operational costs for some countries are extracted from the Regulatory Indicators for Sustainable Energy (RISE) database, which is the most comprehensive World Bank database on energy. Electricity tariffs are recorded for a benchmark subsistence electricity consumption of 30 KWh/month in 2016 US$. Average unitary operational costs provided by the RISE database are representative of the operational costs for electricity generation in the year 2014, for the largest utility in the largest business city of each country, and do not include the operational costs of transmission and distribution. For countries whose tariffs and operational costs were not included in the RISE database, country-specific research was carried out to extract relevant data from the publicly available information of the major electricity utility of the country's capital city. The complete list of countries covered by the RISE database, as well as by other sources, is presented in Appendix 4.

For review of cost-recovery levels, this report draws on the average retail electricity tariffs and levelized costs of energy (LCOE), as calculated based on inputs from Bloomberg New Energy Finance (BNEF) (2017) and Lazard (2016). The LCOE is internationally recognized as the closest measure to the full cost of producing

one unit of energy. The LCOE model is based on a pro-forma, project-finance schedule, which runs through the full accounting of the project based on a set of project inputs, including capital expenses, capacity factors, fixed operations, and management (O&M) expenses; debt ratio; and the cost of equity. For each country, the LCOEs (in 2017 US$/KWh) for each fuel technology are considered to determine a country-wide average cost of producing electricity (per KWh). To calculate these values, the Levelized Costs of Energy (LCOE) for Coal, Gas, and Renewables were taken from Bloomberg New Energy Finance and Lazard. The share (%) of each technology in the electricity mix was taken from the 2017 World Bank World Development indicators, Sources of Electricity Production (2014 data). The LCOE calculations, weighted by technology and considering the energy mix, are based on the following formula: LCOE_Coal * %Coal + LCOE_NGas * %NGas + LCOE_Ren* %Ren + LCOE_Oil * %Oil. Since LCOEs are expressed in MWh, values are transformed into KWh.

The share of renewables has been further weighed, taking into account the country-specific data of electricity generation by renewables technology from the International Energy Agency's (IEA's) IEA Energy Atlas. Finally, LCOE figures are compared to the average electricity tariff, in order to estimate the extent of cost recovery for electricity generation for the six EAP countries for which LCOE data were readily available.

Data on tariffs, operational costs, and operational-cost coverage ratios were collected separately for water and wastewater (used as a proxy for sanitation). Unfortunately, tariff data were available only for a subset of utilities. Because there are no reliable, up-to-date data sets available that measure average water tariffs at the national level across countries, data are not representative of a country's average rates. It is also important to note that water tariffs do not necessarily immediately reveal the relative performance of utilities, because tariff rates are a function of geography and proximity to reliable, quality water resources; tariff policy; efficiency of operations; the geography of distribution; and the costs of inputs. Taking these limitations into account, this report compares municipal-level tariffs in the largest cities (by population) for each country, for informational purposes.

The main sources of data are the IBNET database, supported by the World Bank since 1997, and Global Water Intelligence (GWI), a water-market intelligence company. Water-supply tariff data are available at the municipal level, with the latest data available from Global Water Intelligence in 2016. For countries not included in the GWI and IBNET databases, country-specific research was conducted to extract the relevant data from reports or websites of major water-utility companies. Water tariff and cost data also face limitations due to age and representativeness (see Appendices 6 and 7).

Water-supply tariffs for 2016 are reported for the largest cities in each country, for tariff blocks at the subsistence level of $15m^3$ per month, in 2016 US$. Data on wastewater tariffs, operating costs, and operating-cost coverage ratios (OCCRs) are gathered from the IBNET tariffs database (for wastewater tariffs) and the IBNET benchmarking database (for water and wastewater operational costs). The OCCR represents the extent to which a utility covers its basic operating and maintenance costs by its revenues and is a measure of total annual operational revenues divided by total annual operating costs. Although this measure does not fully assess cost recovery (which would require consideration of capital expenditures), it remains a valuable measure of the extent to which operating costs are met by collected revenues. OCCR figures are the result of a weighted average of all water utilities covered by the IBNET database for each country and can be considered representative of the majority of the urban population.

Because the IBNET figures are based on self-reported data from water utilities, the data presented for each country represents different numbers of utilities and population coverage for each country. Most countries have data representing at least 60 percent of the country's total urban population, suggesting a relatively high level of representativeness for urban services. Those that do not are noted in Appendix 6.

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Appendix 4: Electricity Tariff Sources

The following is a list of sources for average electricity tariffs across all user groups (US$/KWh). Values are calculated based on the total revenues divided by total capacity sold.

COUNTRY	SOURCE/YEAR
Afghanistan	RISE database, 2017 (using 2014 data)
Bangladesh	RISE database, 2017 (using 2014 data)
Bhutan	ADB, 2010. Bhutan: Energy Sector Evaluation Study. https://www.oecd.org/countries/bhutan/47177609.pdf
Cambodia	RISE database, 2017 (using 2013 data)
China	RISE database, 2017 (using 2014 data)
India	RISE database, 2017 (using 2012 data)
Indonesia	RISE database, 2017 (using 2014 data)
Japan	RISE database, 2017 (using 2014 data)
Korea	RISE database, 2017 (using 2014 data)
Lao PDR	RISE database, 2017 (using 2013 data)
Malaysia	RISE database, 2017 (using 2013 data)
Maldives	RISE database, 2017 (using 2014 data)
Mongolia	RISE database, 2017 (using 2013 data)
Myanmar	RISE database, 2017 (using 2014 data)
Nepal	RISE database, 2017 (using 2014 data)
Pakistan	RISE database, 2017 (using 2014 data)
Philippines	RISE database, 2017 (using 2014 data)
Singapore	SP Group, 2020. Q1 2020 Tariff Rates explanation. https://www.spgroup.com.sg/what-we-do/billing
Solomon Islands	RISE database, 2017 (using 2014 data)
Sri Lanka	RISE database, 2017 (using 2014 data)
Thailand	RISE database, 2017 (using 2014 data)
Vanuatu	RISE database, 2017 (using 2014 data)
Vietnam	RISE database, 2017 (using 2014 data)

Appendix 5. Operational Costs of Electricity Generation Sources

The following is a list of sources, regions of source coverage, and specific utility sources (where applicable) for average operational cost of electricity generation (US$/KWh). Because definitions and approaches to calculation differ somewhat across sources, specific terms included the each source are also specified.

COUNTRY	REGION	UTILITY	SOURCE/YEAR	SOURCE COST DEFINITION
Afghanistan	National average	DABS Da Afghanistan Breshna Sherkat	World Bank estimate for average cost of electricity generation (domestic), based on Da Afghanistan Breshna Sherkat data. 2020	Average operational cost of electricity generation
Bangladesh	National average (majority of national coverage and all urban areas)	Bangladesh Power Development Board	BPDB Annual Report 2016-17 (using 2016 data). http://www.bpdb.gov.bd/bpdb_new/resourcefile/annualreports/annualreport_1542104191_Annual_Report_2017-18_2.pdf	Per unit generation cost
Bhutan	National average	Druk Green Power Corporation and Bhutan Power Corporation	Druk Green Power Corporation, 2020. https://www.drukgreen.bt/domestic-power-tariff-revision-proposed/	Unsubsidized cost of supply per unit of electricity to residential consumer; recorded generation cost includes financing cost, returns on equity and operational costs.
Cambodia	National average	World Bank ESMAP report	World Bank, 2017. ESMAP: Mini Grids in Cambodia - Case Study of a Success Story. http://documents.worldbank.org/curated/en/143871512392218868/pdf/ESM-bCambodiaMiniGridsCaseStudyConfEd-PUBLIC.pdf	Average cost of generation
China	Beijing	Huadian Energy	Huadian Energy, 2017. 2017 Annual Report, http://static.sse.com.cn/disclosure/listedinfo/announcement/c/2018-04-26/600726_2017_n.pdf; Comments: 6.759 LCU per 2017 USD; total power generation - 23.828 billion kwh	Estimated average cost of generation estimate based on recorded expenditures and total power generation
Fiji	National average	Fiji Electricity Authority	Fiji Electricity Authority, 2016. 2016 Annual Report, http://efl.com.fj/wp-content/uploads/2017/08/fea-annual-report-2016.pdf	Estimated cost of generation based on total generated output, generation expenditure including thermal and IDO fuel expenditures
India	–	–	–	–
Indonesia	National average	–	PWC, 2017. Power in Indonesia 2017 (using 2016 data). https://www.pwc.com/id/en/energy-utilities-mining/assets/power/power-guide-2017.pdf	Estimated average electricity supply cost
Japan	Tokyo	–	Institute of Energy Economics, Japan, 2017. Economic and Energy Outlook of Japan through FY2018. https://eneken.ieej.or.jp/data/7532.pdf	Electricity unit cost based on sum of fuel cost, FIT purchasing cost, and grid stabilising cost divided by total generation
Lao PDR	National average	–	PWC, 2016 (using 2015 data). Enhancing Financial Sustainability of the Power Sector in Laos and Developing a Suitable Tariff Regime: Task 1 Report, internal communication.	Average cost of supply

COUNTRY	REGION	UTILITY	SOURCE/YEAR	SOURCE COST DEFINITION
Malaysia	Kuala Lumpur	Tenga Nasional Berhad	Tenga Nasional Berhad, 2017. TNB Annual Report 2017. https://www.tnb.com.my/assets/annual_report/TNB_Annual_Report_2017.pdf	Estimated generation cost based on operating costs (excluding transmission and distribution costs) and recorded KWh sold
Maldives	National average	State Electric Company Limited (STELCO)	World Bank, 2015. PID: Small Island ASPIRE Supplement. http://documents.worldbank.org/curated/en/534201468263694275/pdf/SG-PRW-PID-CP-P155126-07-24-2015-1437756406859.pdf	Average cost of electricity generation
Mongolia	–	–	–	–
Myanmar	Yangon	Yangon Electricity Supply Corporation	EuroCHAM Myanmar, 2018. Energy Guide 2018. https://www.ccifrance-myanmar.org/sites/ccifrance-myanmar.org/files/resources-documents/energy_guide_2018.pdf	Estimate based on range of average costs of generation for hydropower and gas
Nepal	National average	Nepal Electricity Authority	Nepal Electric Authority, 2019. 2019 Annual Report. http://www.nea.org.np/annual_report	Estimate based on generation operating costs and KWh sold
Pakistan	Karachi	Karachi Electric Supply Company Limited	Pakistan Today, 2017. https://profit.pakistantoday.com.pk/2017/11/22/induction-of-new-power-plants-electricity-generation-cost-jacks-up-to-24pc/	Average electricity generation cost
Papua New Guinea	National average	PNG Power	The World Bank, 2017. PNG Electrification Project - Project Information Document. http://documents.worldbank.org/curated/en/271221492070865535/pdf/ITM00184-P159840-04-13-2017-1492070863300.pdf	Average electricity generation cost
Singapore	Singapore	SP Group	SP Group, 2020. Q1 2020 Tariff Rates explanation. https://www.spgroup.com.sg/what-we-do/billing	Energy Cost (paid to the generation companies) per KWh
Solomon Islands	Honiara	Solomon Islands Electricity Authority	Solomon Power, 2018. Annual Report 2018. http://solomonpower.com.sb/about-us/annual-reports/	Estimate based on generation cost per KWh
Sri Lanka	National average	Ceylon Electricity Board (CEB)	Ceylon Electricity Board, 2018. Statistical Digest 2018. https://www.ceb.lk/front_img/img_reports/1567487133Statistical_Digest_2018.pdf	Estimate based on average cost per unit at selling point
Thailand	National average for operator supplying 37% of nation's electricity	Electricity Generation Authority (includes MEA and PEA)	Electricity Generating Authority of Thailand, 2017. Annual Report 2017. http://www.egat.co.th/en/images/annual-report/2017/egat-annual-eng-2017.pdf	Estimate based on operational costs of generation and fuel inputs for electricity generation

Appendix 6. Water and Wastewater Tariff Sources

The following is a list of input sources and municipalities associated with the retail water tariffs (US$/m^3) for the consumption band of 15 m^3 per month and wastewater tariffs (US$/m^3)

COUNTRY	MUNICIPALITY	UTILITY / AUTHORITY	SOURCE / YEAR
Afghanistan	Kabul	Afghan Water Supply and Sewerage Corporation	World Bank estimate based on local utility data (2020)
Bangladesh	Dhaka	Dhaka Water Supply and Sewerage Authority	GWI database (2017)
Bhutan	Thimphu City	Thimphu City Corporation	GWI database (2017)
Brunei Darussalam	Bandar Seri Begawan	Jabatan Perkhidmatan Air	GWI database (2017)
Cambodia	Phnom Penh	Phnom Penh Water Authority	GWI database (2017)
China	Shanghai	Shanghai Water Supply Company	GWI database (2017)
Fiji	Suva	Water Authority of Fiji	IBNET database (2017 data)
India	Mumbai	Municipal Corporation of Greater Mumbai	GWI database (2017)
Indonesia	Jakarta	Palyja	GWI database (2017)
Japan	Tokyo	Bureau of Waterworks Tokyo	GWI database (2017)
Korea	Seoul	Arisu	GWI database (2017)
Lao PDR	Vientiane	Nampapa Nakhone Luang	IBNET database (2018 data)
Malaysia	Kuala Lumpur	SYABAS (water) and Indah Water (sewerage)	GWI database (2017)
Maldives	Male	Maldives Water and Sanitation Company	IBNET database (2015 data)
Mongolia	Ulaanbaatar	Water Supply and Sewerage Authority of Ulaanbaatar	GWI database (2017)

COUNTRY	MUNICIPALITY	UTILITY / AUTHORITY	SOURCE / YEAR
Myanmar	Yangon	Yangon City Development Committee	IBNET database (2020 data)
Nepal	Kathmandu	Kathmandu Upatyaka Khanepani Limited (KUKL)	GWI database (2017)
New Zealand	Auckland	Watercare	GWI database (2017)
Pakistan	Karachi	Karachi Water and Sewerage Board (KWSB)	GWI database (2017)
Papua New Guinea	Port Moresby	Eda Ranu Water and Sewerage Company	GWI database (2017)
Philippines	Manila	Maynilad Water Service Inc, Manila Water Company	GWI database (2017)
Samoa	Apia	Samoa Water Authority (SWA)	Samoa Water Authority, 2020. Water & Wastewater Tariffs. https://www.samoawaterauthority.ws/tariffs
Singapore	Singapore	Public Utility Board (PUB)	GWI database (2017)
Solomon Islands	Guadacanal Province	Solomon Islands Water Authority	IBNET database (2016 data)
Sri Lanka	Colombo	National Water Supply and Drainage Board	GWI database (2017)
Thailand	Bangkok	Metropolitan Waterworks Authority	GWI database (2017)
Timor-Leste	–	–	–
Vanuatu	Port Vila	Unelco Vanuatu	IBNET database (2019 data)
Vietnam	Ho Chi Minh City	Ho Chi Minh City Water Company	GWI database (2017)

Appendix 7: Water Quality and Expenditure Sources

The following is a list of sources for Non-Revenue Water (%); Quality of Water Supplied (% samples passing on residual chlorine); Operational Expenditure, Water & Wastewater (US$/$m^3$ water sold); Operational Expenditure, Water (US$/$m^3$ water sold); Operating Cost Coverage (ratio); and Operational Expenditure, Wastewater (US$/population served).

COUNTRY	# UTILITIES IB-NET DATABASE	% URBAN POPULATION COVERED BY IBNET	SOURCES
Afghanistan	1	21%	IBNET Benchmarking database (2013 data)
Bangladesh	47	42%	IBNET Benchmarking database (2017 data)
Bhutan	n/a	n/a	Annual Performance Report, 2017, Thimphu Thomde. http://www.thimphucity.bt/counter/direct_download/427
Cambodia	1	66%	IBNET Benchmarking database (2013 data)
China	42	3%	IBNET Benchmarking database (2012 data)
Fiji	1	63%	IBNET Benchmarking database (2018 data)
India	n/a	n/a	Ministry of Urban Development, Government of India. 2011. Service Levels in Urban Water and Sanitation Sector Status Report, 2010-2011. National averages for non-revenue water, quality, and cost coverage. https://smartnet.niua.org/sites/default/files/resources/SLB%20Service%20Levels%20in%20Urban%20Water%20and%20Sanitation%20%282010-11%29.pdf
Indonesia	n/a	n/a	KPI for Indonesia Water Utilities, direct communication, 2017
Japan	n/a	n/a	Operational expenditure data source: Japan Water Works Association (2016). Water Supply in Japan 2016. Tokyo, Japan. http://www.jwwa.or.jp/jigyou/kaigai_file/2016WaterSupplyInJapan.pdf
Korea	161	100%	IBNET Benchmarking database (2014 data)
Lao PDR	1	20%	IBNET Benchmarking database (2016 data)
Malaysia	n/a	n/a	Ministry of Energy, Green Technology, and Water, 2020 (2015-2016 data). http://www.data.gov.my/data/en_US/dataset/non-revenue-water
Mongolia	1	48%	IBNET Benchmarking database (2017 data)
Nepal	26	60%	IBNET Benchmarking database (2015 data); except wastewater expenditure (2017 data)

COUNTRY	# UTILITIES IB-NET DATABASE	% URBAN POPULATION COVERED BY IBNET	SOURCES
New Zealand	51	99%	IBNET Benchmarking database (2018 data)
Pakistan	1	9%	IBNET Benchmarking database (2016 data); except wastewater expenditure (2012 data)
Papua New Guinea	2	89%	IBNET Benchmarking database (2018 data)
Philippines	n/a	n/a	World Bank Water and Sanitation Program, 2015. Water Supply and Sanitation in the Philippines: Turning Finance into Services for the Future. https://www.wsp.org/sites/wsp/files/publications/WSP-Philippines-WSS-Turning-Finance-into-Service-for-the-Future.pdf
Samoa	1	>99%	IBNET Benchmarking database (2018 data)
Singapore	n/a	n/a	Singapore Public Utilities Board, 2018. Annual Report 2017/2018. https://www.pub.gov.sg/Documents/annualreport2018.pdf; Unaccounted-for water value from Government of Singapore, 2015 https://blog.data.gov.sg/hidden-data-stories-unaccounted-for-water-e5523c4c6058; Data for operational expenditure from Public Utilities Board, 2018 https://www.pub.gov.sg/Documents/Dom_Usave_EngChi.pdf
Solomon Islands	1	53%	IBNET Benchmarking database (2019 data)
Sri Lanka	n/a	n/a	NRW, OCCR: Central Bank of Sri Lanka, 2018. Annual Report 2018. https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/annual_report/2018/en/7_Chapter_03.pdf; Unit Operational Expenditure based on estimates from Dharmaratna and Parasnisand, 2012. https://globalwaterforum.org/2012/09/22/the-cost-structure-of-water-supply-in-sri-lanka/
Thailand	n/a	n/a	Metropolitan Waterworks Authority (2017). "Annual Report 2017." Bangkok
Vanuatu	2	80%	IBNET Benchmarking database (2018 data)
Vietnam	75	97%	IBNET Benchmarking database (2015 data)

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