



Partnership Ready Cambodia: Water supply and wastewater treatment

Sector overview

The Kingdom of Cambodia has a tropical monsoon climate, which means the country's weather is characterised by two distinct seasons: a dry season lasting from November to April and a wet season from May to October. These two seasons bring with them corresponding water shortages and surpluses. Average annual rainfall is about 1,400 mm. Shallow aquifers underlying the floodplain and lowlands serve as natural groundwater stores and transmission systems, which render the construction of surface canals obsolete. The interaction between the Tonle Sap ecosystem (lake and river) and the Mekong River is unique: when the level of the Mekong rises during the wet season, its waters flow from the Mekong up into the Tonle Sap Lake via the Tonle Sap River, leading to an increase in the lake's size from 2,600 km² to around 10,500 km². This flow reverses during the dry season when the Tonle Sap River transports water from the lake down to the Mekong.

Two decades of strong economic growth, rapid urbanisation, and agricultural and industrial development, together with the emergence of a growing middle class, have significantly increased the amount of water consumed and wastewater generated in the Kingdom. It is therefore unfortunate that the amount of people



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provided with drinking water supply and with access to sanitation facilities, and the country's wastewater treatment capacity have yet to grow accordingly. The disparities between urban and rural areas are significant: Only around 20% of rural residents can access clean water, while in population centres the rate is 70%. For this reason, the National Strategy for Rural Water Supply, Sanitation and Hygiene 2011-2025 formulates the target of 100% access to water supply, sanitation and hygiene across the country. For its part, the Ministry of Industry and Handicraft (MIH) is prioritising water supply in all cities and districts. Nationally, the number of wastewater treatment plants is also expected to increase in the future.

Water supply and wastewater treatment are becoming major concerns for the Cambodian authorities and development partners. Cambodia's population and corporations remain insufficiently aware of the need for efficient water use. The main reason for this is assumed to be the low cost of water, which is significantly cheaper than electricity, for example. Indeed, water supply fees have not been raised in 10 years. In the capital, the fee is 950 riel/m³ (EUR 0.21) for commercial customers and 550 riel/m³ (EUR 0.12) for domestic customers. In most other cities and provinces, water fees are slightly higher, e.g. 1,100 riel/m³ (EUR 0.24) for domestic use in Siem Reap. Wastewater fees in the bigger cities are collected by the Phnom Penh and Siem Reap Water Supply Authorities (SRWSA) and represent 10% of the water bill. The fee is transferred to the Ministry of Public Works and Transport (MPWT), which is in charge of implementing a wastewater policy.



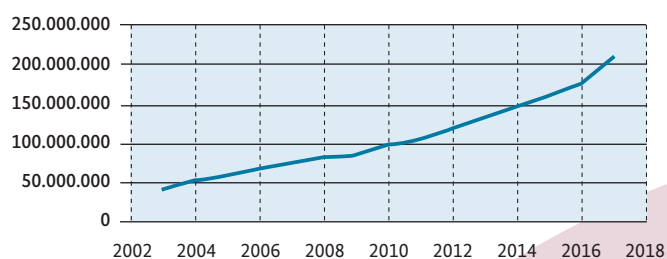


Water supply

Water for agricultural irrigation is directly pumped at source (from rivers, lakes and the ground). Given the risks of depletion, the Ministry of Water Resources and Meteorology (MOWRAM) has adopted a precautionary approach to groundwater use, limiting its use to supplementary provision rather than to full irrigation in the dry season. While these approaches reflect best practice, they are however difficult to implement at a large scale. In Siem Reap Province, it is forbidden to use groundwater due to the potential negative effects of extraction on the stability of temples in the area. The enforcement of this ban is, however, weak. In 2017, UNESCO reported that the increasing tourism and population in Siem Reap have caused water shortages, forcing SRWSA to tap into the groundwater. Besides irrigation, groundwater is also used by industries and, in many areas, it is the main source of domestic water supply. Even though relevant data are not available, negative impacts can be assumed if this extraction continues to increase in an uncontrolled way. Groundwater quality is generally satisfactory, but high iron levels and salinity occur in some areas. In addition, leachates from agriculture and landfills affect water quality. Large hydropower projects on the Mekong and its tributaries are likely to have detrimental effects on access to water for downstream communities and countries when the water level is low.

Cambodia's geographical situation and climate mean the Kingdom's authorities have diverse resources at their disposal for supplying households and businesses with drinking water. The disparity in water services between the town and the countryside is significant. Populations in urban areas have three times more access to sanitation facilities than those in rural and peri-urban areas. The lack of reliable and sustainable water supply systems is

Production of water in Phnom Penh from 2002 to 2018 in m³ per day (Source: PPWSA, 2018)



therefore a common issue and remains a prevalent health concern, especially in rural areas. The six water treatment plants currently in operation are able to supply good quality water to the Kingdom's major urban centres: Battambang, Kampong Cham, Kampot, Phnom Penh, Siem Reap and Sihanoukville. Decentralised supply through rainwater capture is mostly practised by households and farmers, but rarely by state and corporate actors.

Development agencies (especially the French Development Agency [AFD] and the Japan International Cooperation Agency [JICA]) and other international funding partners (such as NGOs and development banks) have contributed to the development of water treatment facilities and their management, especially in Phnom Penh. As a result, the state-owned Phnom Penh Water Supply Authority (PPWSA) has received several awards, such as the Stockholm Industry Water Award, for its impressive accomplishments.

The PPWSA was officially established in 1959 by King Norodom Sihanouk under the direct supervision of the Phnom Penh Municipality. The organisational structure of the PPWSA is effective and transparent, comprising five departments: Administration and Human Resources, Commerce, Finance and Securities Exchange, Production and Distribution, and the Plan and Project Department. The PPWSA has more than 1,000 employees and a current capacity of 580,000 m³ of water per day. Furthermore, it also supplies communes outside of Phnom Penh Municipality. With the Cambodian capital continuing to grow, the PPWSA is preparing a new project, which will be implemented as soon as the water treatment facility in Chamkar Mon is completed (see under Business Opportunities below). To supply water to the poorest households, the PPWSA has set up the Clean Water for the Poor programme, which includes schemes for paying in instalments, discounts for connection fees in suburban communities and a subsidy policy.

In Phnom Penh, water is extracted from the rivers Tonle Sap and Mekong (rainwater and groundwater are not used). The treatment process involves hydraulic mixing (lime, alum and chlorine), flocculation (mechanical mixer), sedimentation (rectangular basin), rapid sand filtration (fine sand) and disinfection (chlorine). Storage tanks and high-lift pumps are used for distribution. The drinking water has the same quality standards as that of many developed countries, and the distribution system is being continuously modernised, so leakages are rare. However, citizens' level of trust in water quality is low – partly because the water tanks on the roofs of many houses are barely maintained – so bottled water consumption remains common, even in Phnom Penh.



In February 2019, the Cambodian firm Anco Group announced it was investing USD 20 million in the construction of two water treatment plants in Kampot Province. Five months later, in July, building work got under way. Feasibility studies on investments in water treatment plants were conducted by several Chinese firms in the province, but the government has not approved any of these investments yet because of the high production costs involved. In Preah Sihanouk Province, Anco has completed two main reservoirs which are each able to produce about 60,000 m³ per day. However, Sihanoukville's fast development has affected the supply of clean water. Prek Tup lake, a major water source, has partly been filled with sand.

→ WASTEWATER TREATMENT

Even though discharging untreated and low-quality treated wastewater carries environmental and health-related risks, it remains a common practice in Cambodia because the systems required to treat wastewater are insufficiently developed.

The country has no sewerage master plan and no comprehensive wastewater strategy in place. Therefore, in the absence of reliable figures, it can be assumed that the percentage of wastewater that gets treated is very low. Wastewater from households and businesses often ends up flowing into rivers. Septic tank systems

are not installed in all buildings. Where they are installed, their performance is questionable, and when they fail, the wastewater they contain passes into the groundwater. Businesses next to sewerage systems channel their wastewater directly into them, and the presence of rubbish in these systems causes blockages. During the dry season, the concentration of sewage and pollutants in sewerage systems and the receiving water bodies becomes particularly high due to the lack of water in them for dilution. Separate sewerage systems for blackwater, greywater and rainwater do not exist in Phnom Penh. Sewage water flows via the sewerage systems (Boeng Trabek and Steoung Meanchey) into the Boeung Choeung Ek Lake, which receives 80% of the sewage water from the city along with untreated effluent from 3,000 small and large-scale industrial enterprises. The lake acts as a natural wastewater treatment area before the water reaches the Bassac River. Furthermore, complete underground plans of the drainage network and data on sewage are missing. The increasing sealing of surfaces in urban areas leads to flooding during heavy rainfall, which in turn sees sewage entering into low-lying areas. Since 1997, 15 of the 25 largest lakes (e.g. Boeung Kak Lake) and canals in the capital have been deliberately filled in with sand and mud to provide space for construction.

Huge investments are needed for the installation of wastewater treatment plants in large cities. However, the sector is seriously underfinanced. For example, in Phnom Penh, only 10% of the



Open Sewer in Phnom Penh



Filling of Boeung Kak Lake in Phnom Penh

income received by the PPWSA from water bills is allocated to the sewerage system and wastewater treatment. Furthermore, it is not possible to determine whether these allocated funds actually end up being used for the maintenance and improvement of relevant infrastructure. The MPWT has the overall responsibility for wastewater treatment and financing. However, there are no streamlined procedures for establishing plants and little expertise is available. Therefore, in addition to financing, another challenge is the lack of institutional capacity.

The current situation could evolve due to increased pressure from tourism and the expansion of cities, making wastewater treatment even more urgent. However, major improvements will only occur if tourism-related development and urban growth occur in conjunction with integrated water resource management. For instance, many treatment facilities have recently been set up in hotels, apartment buildings and business premises. These facilities are small because they are designed to treat wastewater generated by a limited number of people. This development can be seen as progress; however, what is needed is a holistic approach to integrate these small-scale projects in a comprehensive plan.

Since most treatment plants are decentralised solutions, their number and total capacity are unknown. While Siem Reap, Sihanoukville and Battambang have wastewater treatment plants, these growing cities continue to face challenges because the current capacity of their facilities is insufficient to meet their needs. The plant in Siem

Reap has a treatment capacity of 3,000 m³ per day, is operated by natural gravity flow and consists of six ponds (two anaerobic ponds, two facultative ponds and two maturation ponds). A current project will increase the capacity of the city's sewerage system to 8,000 m³ per day. Sihanoukville's system serves some 30,000 people over an area of around 221.5 ha and treats 1,200 m³ of wastewater from a brewery per day. An inter-ministerial committee is taking urgent action in Sihanoukville to develop the infrastructure needed to treat 30,000 m³ of wastewater per day. As a result of the degradation of Battambang's system, the daily capacity of its treatment plant has dropped from 1,000 m³ to 450 m³.

As is often the case, Special Economic Zones (SEZs) represent promising exceptions, because it is compulsory for SEZs to have wastewater treatment facilities. Phnom Penh SEZ (PPSEZ) has its own system, which includes facilities ranging from rainwater collection infrastructure and a groundwater pumping station to a wastewater treatment plant. The latter has a capacity of 4,500 m³ per day and passes the water it treats through a primary pond, lagoon, settling pond and final pond before discharging it into the river. However, not all the SEZs serve as good examples. A 2013 JICA report noted that Tai Seng Bavet SEZ was discharging its wastewater into paddy fields, thus violating Cambodia's environmental standards. In 2016, despite the construction of a new USD 20 million wastewater treatment facility for the SEZ, local villagers again complained that untreated water was being discharged from the industrial park.



Policy and regulation

Various ministries and governmental authorities have different responsibilities for the management of water resources and wastewater treatment, as outlined in the table below.

Ministries and authorities	Responsibilities
Ministry of Water Resources and Meteorology (MOWRAM)	Overall management of water resources in Cambodia.
Ministry of Industry and Handicraft (MIH)	In charge of providing drinking water in 11 provincial capitals and for approximately 60 medium-sized and small towns.
Phnom Penh Water Supply Authority (PPWSA) and Siem Reap Water Supply Authority (SRWSA)	Public independent enterprises in charge of providing drinking water in Phnom Penh and Siem Reap respectively.
Ministry of Rural Development (MRD)	In charge of water supply in rural areas and in towns with fewer than 1,000 households.
Ministry of Public Works and Transport (MPWT)	In charge of wastewater management. At the sub-national level, provincial departments of the MPWT implement the policies adopted at the national level.
Ministry of Agriculture, Forestry and Fisheries (MAFF)	In charge of providing water to the agricultural sector.

The following table lists the most important laws and regulations governing the water and wastewater sector.

Year	Title	Type and number	Description
1999	Sub-decree on the Control of Water Pollution	Sub-decree No 27	Determines water pollution controls for prevention purposes in order to ensure human health and conserve biodiversity.
2005	Sub-decree on the Establishment and Management of the Special Economic Zone	Sub-decree No 148	Aims to manage and govern the SEZ scheme, setting rules related to wastewater treatment. A SEZ must have a wastewater treatment network.
2007	Law on Water Resources Management of the Kingdom of Cambodia	Law	Aims to promote the effective and sustainable management of water resources in Cambodia.
2017	Sub-decree on the Management of Drainage System and Wastewater Treatment System	Sub-decree No 235	Aims to increase the efficiency and transparency of Cambodia's drainage and sewerage system, and of its managing authorities.

In addition to sectoral policies and regulations, it is useful to consider the consolidated Law on Investment of 2003. Under this legislation, foreign investors can apply to the Council for the Development of Cambodia (CDC) or the Provincial-Municipal Investment Sub-Committee (PMIS) for their project to be treated as a Qualified Investment Project (QIP) and thereby benefit from governmental investment incentives. According to Sub-decree No 111, clean water supplies are eligible for QIP status, provided that the investment is equal to or greater than USD 500,000. Furthermore, a number of tax incentives exist for investments in SEZs – e.g. there are incentives on the importation of equipment and construction materials to be used for building infrastructure in the zone, and machinery imported for industrial operations in the SEZs is exempted of import duties and other taxes.

The most relevant private sector business association is the Cambodian Water Supply Association (CWA). The CWA has 252 members, which include large, medium and small enterprises. 224 members are private water operators and 27 members are suppliers to operators. The 27 members include corporations from Singapore, China, Japan and Thailand. The CWA has set up partnerships with the Australian Water Association (AWA), Kitakyushu Overseas Water Business Association (KOWBA), and Honor Mice Group (Inter Water China). The CWA's main mission is to support the development of private operators in Cambodia. Main activities include both capacity-building on business development, technical matters for private operators and access to loans, as well as awareness raising at the sub-national level on water source protection and water supply. Through the Water Utilities Improvement Program (WUIP), three Cambodian water operators have been selected to cooperate with the Australian company South East Water to build facilities in Cambodia and enhance the performance in dosing, water lost management and chlorine contact time. Furthermore, CWA facilitates the organisation of the Cambodian Water Conference and Exhibition.



Business opportunities

The huge backlog of work to develop Cambodia's water supply and wastewater treatment capacity presents a range of business opportunities. In the water supply sector, these opportunities mainly relate to the following donor-oriented projects:

- the introduction of geographical information systems (GIS) for controlling and monitoring technical processes (e.g. in waterworks);
- the installation of water quality control equipment in the drinking water network;
- equipment for carrying out leak detection;
- frequency inverters for pumping stations to regulate output into the drinking water pipe network;
- cleaning of pipe networks;
- installation of wheel pumps;
- training on planning operational management capacities.

While the market for wastewater treatment has still not reached its full potential in terms of profitability, invitations to tender issued by governmental authorities and international donors could present European companies with interesting opportunities in:

- the supply of filtration and water treatment technologies and of equipment for the lifting and transportation of water;
- the distribution of other components;
- qualification of skilled labour;
- design and planning;
- solutions for the treatment of faecal sludge;
- decentralised wastewater treatment plants.

The current development of the real estate and tourism sector may increase the number of potential clients. A European company could supply private entities that are aware of the hygiene and sanitation challenges present in urban areas. In such cases, the treatment capacity required could be below 50 m³ per day. However, small-scale projects are not deemed to be beneficial for European companies that are not already based in the ASEAN region.

International organisations and donors, such as the AFD, JICA, KfW Development Bank, Oxfam and the World Health Organization, play an important role in terms of financial support, technology transfer and the provision of knowledge and services. However, companies should be aware that the processes to secure a contract from the World Bank or Asian Development Bank (ADB) are long and complicated, especially for those companies without any prior experience of working in developing countries. For these companies, a more interesting way to enter the market may be as a sub-contractor for an implementing company.

To gain a better understanding of the opportunities, it is useful to consider some examples of successful foreign private sector engagement and of specific project opportunities.

Most water supply and wastewater treatment projects in rural areas are implemented by international NGOs, which often work in concert with local NGOs. Currently, NGOs are working on 25 projects to develop drinking water supplies and water sanitation in Cambodia. These projects have a total value of USD 163 million and include the following:

- Oxfam has been involved in rolling out wheel pumps for existing wells in Pursat Province.
- Water for Cambodia is promoting biosand filters that enable households in rural areas to produce drinking water from contaminated water sources. Compared to well water, water treated using biosand contains less iron.
- The German organisation BORDA promotes decentralised waste and wastewater solutions and, with UNICEF funding, has been particularly active in schools.

The PPWSA has financial resources available to contribute to the construction and renovation of water treatment plants. Supported by the AFD and other development partners, the PPWSA organises public tenders that fall into three categories: consultancy, construction, and pipes. European companies can bid directly for these contracts or can participate as a supplier to a main contractor (e.g. as a supplier of hydraulic equipment). Considering the pace of urban growth in Phnom Penh, the PPWSA organises public tenders for the fulfilment of projects according to its long-range planning. In this context, the PPWSA, AFD, European Investment Bank (EIB) and Asia Investment Facility (AIF) organised a public tender for the design and build of the largest water treatment plant in Cambodia, the Bakheng Water Treatment Plant, which will be located near Phnom Penh and have a total capacity of 400,000 m³ per day. The overall project has been organised into two phases and will cost USD 247 million. The AFD, AIF and EIB are contributing funding up to USD 200 million and the PPWSA will fund the remainder. Phase I comprises a water treatment plant with a capacity of 195,000 m³. Despite competition from Chinese and neighbouring-country tenderers, Vinci Construction Grands Projets won the Phase I contract, which was then signed at a ceremony held with the PPWSA in November 2019. A number of specialised companies did not bid for this project because, in spite of the project's scope, many of them still do not see Cambodia as a potential market. Another invitation to tender will be organised in the coming years for the construction of the Phase II facilities.



The ADB is funding the Irrigated Agriculture Improvement Project, the Third Rural Water Supply and Sanitation Services Sector Development Programme, and the Water Supply and Sanitation Investment Programme.

Best Practice

Wastewater treatment initiative in Phnom Penh

JICA is currently working on a notable wastewater treatment initiative in Phnom Penh which involves financing, on the one hand, a USD 25 million wastewater treatment plant with a capacity of 5,000 m³ per day and, on the other, sewerage system projects. A memorandum of understanding on the construction of the wastewater plant was signed in May 2019 between the Phnom Penh Capital Administration and JICA, with the contract signing ceremony taking place in October of that year. Prior to this, in March 2019, other projects to improve flood prevention and the sewerage system in Phnom Penh got underway with Japanese grant aid support totalling USD 36 million. These projects include the installation of a main drainage network, the construction of a water pumping facility and the provision of two mobile water pump trucks.

Best Practice

Installation and renovation of water infrastructure

The French company Vinci Construction Grands Projets is currently managing two major projects: the installation of a water intake structure in Siem Reap costing USD 10.4 million and the renovation of the water treatment facility in Chamkar Mon, Phnom Penh, which will complete at the end of 2019. The Chamkar Mon facility, which will produce drinking water by treating water from the Tonle Bassac River, will see its capacity more than double from 20,000 m³ to 52,000 m³ per day. This renovation is cofinanced by the AFD and PPWSA at a cost of around USD 23 million.

Several tender platforms are available for Cambodia. One of these, Cambodia Tenders (see “Practical links and sources”), features invitations to tender in 2020 for the following projects: wastewater treatment plants and septage treatment plants in Sihanoukville and Battambang; Kampong Cham water treatment plant and distribution network; and Battambang water treatment plant and distribution network.

Furthermore, companies are encouraged to explore opportunities in the areas of flood protection and irrigation.

Best Practice

Pilot project on decentralised water treatment

With support from the German implementing agency DEG, from 2015 to 2018, a consortium comprising Aquatec Reuter, EvU Innovative Umwelttechnik GmbH and the Cambodian Education and Waste Management Organization (COMPED) implemented a pilot project aimed at introducing sanitary wastewater treatment systems in remote areas of Cambodia. For project implementation, funds provided by the developPPP.de programme were used. With this programme, the German Federal Ministry for Economic Cooperation and Development (BMZ) supports projects in which development objectives and private sector interests match.



Practical information and sources:

The Cambodia NGO Database of the Council for the Development of Cambodia, accessed in 2019 at: www.odacambodia.com/ngo/index.asp

Sources of information on tenders:

- Public Procurement Portal
www.gdpp.gov.kh (in Khmer)
- DailyBids
www.dailybids.com.kh (mainly in Khmer)
- Cambodia Tenders
www.cambodiatenders.com
- Asian Development Bank
www.adb.org/projects/tenders
- World Bank
www.worldbank.org/en/projects-operations/products-and-services/procurement-projects-programs
- UN Global Marketplace
www.ungm.org/Public/Notice



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