

ECONOMIC ANALYSIS

A. Introduction

1. Cambodia's urban population is estimated at 2.96 million or 20% of its total population of 14.7 million in 2013.¹ This is expected to almost double to 5.6 million by 2030 as a result of stronger links among Cambodia's towns, globalization, and regional cooperation in the Greater Mekong Subregion (GMS).

2. Rapid urbanization has strained the government's capacity to provide public services and infrastructure to accommodate increases in trade and the flow of goods and people from neighboring countries.

3. The government's inability to achieve financial sustainability and the weak regulatory environment have contributed to limited participation by the private sector in urban services provision such as solid waste, wastewater treatment, and drainage, particularly for the urban poor and other vulnerable groups. This has resulted in inadequate quality, availability, and accessibility of services.

4. For Cambodia to maximize the benefits of the current economic development in the GMS, the government urgently needs to improve the competitiveness of its cities along the strategic economic corridors by investing in priority infrastructure and strengthening the investment framework to attract more private sector participation in public services and infrastructure. Kampot and Sihanoukville, the administrative capitals and urban centers of the provinces of the same names, are situated in southern Cambodia along the GMS Southern Economic Corridor. Both have good strategic road connections with Ho Chi Minh City, Bangkok, and Phnom Penh. Kampot is on the Kampot River, close to the Bokor National Park and the attractive coastline of the Gulf of Thailand. It has the potential to be a key port link for the outlying islands, including Viet Nam's established resort island of Phu Quoc. Sihanoukville has an international container port, an international airport, and a special economic zone. The city has some internationally known beaches, with good access to outlying islands including Koh Thmei, Koh She, and Phu Quoc. It is also close to the Ream National Park. Despite being strategically located, both cities have made minimal capital investment to improve public infrastructure. The project will finance some priority solid waste, wastewater treatment, and drainage investments.

B. Overall Approach to Economic Analysis

5. The economic analysis of the investments was undertaken in accordance with the principles and procedures set out in the Asian Development Bank (ADB) guidelines.² The period of analysis extends over 25 years from the start of project implementation in 2016 to 2040. Costs and benefits were quantified at April 2015 prices and converted to their economic cost equivalents using shadow prices. Costs include construction, land acquisition and resettlement, capacity building, project management support, and physical contingencies. An exchange rate of \$1 = KR4,000 was used to convert foreign exchange costs to local currency equivalent. All costs were valued using the domestic price numeraire. Economic costs were derived from the

¹ 2013 Cambodia Intercensal Population Survey.

² These guidelines include the following: ADB. 2013. *Cost-Benefit Analysis for Development: A Practical Guide*. Manila; ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila; ADB. 1999. *Guidelines for the Economic Analysis of Water Supply Projects*. Manila; ADB. 1994. *Framework for the Economic and Financial Appraisal of Urban Development Sector Projects*. Manila.

technical team's financial estimates of investment and recurrent costs, adjusted for transfer payments and other market distortions. Taxes and duties were excluded because they represent transfer payments. Traded goods, net of taxes and duties, were adjusted by the shadow exchange rate factor of 1.1, while for unskilled labor the shadow wage rate factor of 0.75 was used.³ Both costs and benefits were treated as increments to a without-project situation.

6. The economic viability of the project was determined by computing the economic internal rate of return (EIRR) and comparing the result with the assumed economic opportunity cost of capital of 12%. An EIRR exceeding 12% indicates economic viability. The viability of the investments was further tested by changing key variables: (i) 10% increase in capital costs, (ii) 10% increase in operation and maintenance (O&M) costs, (iii) 10% decrease in benefits, and (iv) 1 year delay in benefits. Distribution of project net economic benefits resulting from the investments and poverty impact analysis were also undertaken to determine how much of the net economic benefits will directly benefit the poor.

C. With- and Without-Project Situations

7. The project will construct and improve the following:
- (i) **Kampot wastewater collection and treatment.** Although most urban properties have septic tanks and pit latrines, there is currently no wastewater treatment system in Kampot city. Wastewater flows directly into the Kampot River causing heavy pollution and foul smells during the dry season and at low tide. The proposed subproject will consist of a separate wastewater collection system and a lagoon-type wastewater treatment plant, which were evaluated as the least-cost technical solutions.
 - (ii) **Kampot solid-waste management.** A private company currently collects and transports solid waste from about 2,750 customers to a dump site operated by the province in Prey Khom commune, with no leachate collection, cell management system, organized compaction, or regular earth covering. The subproject will close the existing dump site and establish a new facility with planned cell development, clay lining, leachate collection and storage, regular waste covering, covered soil storage, surface water management and groundwater monitoring, equipment for waste collection and handling, and a public awareness campaign, which was evaluated as the least-cost technical solution.
 - (iii) **Kampot urban drainage.** Kampot city has a combined wastewater and storm water drainage system consisting of covered roadside drains which mostly drain to outfalls to the Kampot River's banks. The city center including the area around the market is particularly flood prone during the rainy season. The subproject will construct a separate storm water drainage collection system to reduce loading in the proposed wastewater treatment plant and also reduce operating costs compared with the existing closed and buried concrete pipes.
 - (iv) **Sihanoukville solid-waste management.** A private company collects the majority of solid waste from 3,949 customers and takes it to a dump site operated by the province approximately 25 kilometers from the main urban area. The dump site's topography is not suited for a landfill or dump site, space is limited, and its physical condition is very poor with no leachate collection or periodic

³ Economic Analysis (available from the list of linked documents in Appendix 2 of ADB, 2012. *Report and Recommendation of the President to the Board of Directors: Cambodia Greater Mekong Subregion Southern Economic Corridor Towns Development Project*. Manila.

earth covering being undertaken. The project will (i) move existing waste to a confined area where it will be compacted in layers and covered with earth; and (ii) open new cells in a managed landfill that will feature clay lining, groundwater monitoring, planned cell development, leachate collection and storage, surface water management, regular covering of waste, controlled waste picking, and a public awareness campaign.

- (v) **Sihanoukville urban drainage.** There are roadside drains along some roads in the urban area. Several are blocked, need replacement, and/or are difficult to maintain, and much of the city including the town center suffers from flooding during the rainy season. New road drains will be constructed, especially on priority strategic link roads in flood-prone areas.

D. Economic Benefits

8. **Kampot wastewater collection and treatment.** Benefits identified are reduced pollution of the Kampot River through higher standards of effluent discharge, and improved sanitation and better public health with lower occurrence of waterborne diseases. In the absence of reliable data on the occurrence of waterborne disease in the area, wastewater revenues and consumer surplus⁴ are used as the surrogate value of the economic benefits. Consumer surplus is based on the willingness to pay (WTP) for the wastewater services of KR3,500 per household per month (which 69% of respondents were willing to pay). Note that the WTP is higher than the proposed initial wastewater tariff of KR2,000.

9. The wastewater revenues were projected based on the following assumptions: the wastewater bill will be collected on the water bill as a surcharge and increase gradually as a percentage of the bill; water tariffs increase by 15% every 3 years starting in 2016 and the water company has only one customer category, hence the same tariff for all customers; water consumption remains at the 2014 level; the number of water supply connections increases by 3.5% every year from the water company's estimated customers of 5,676 in 2016 (53% service coverage) to 8,569 by 2028 (75% service coverage);⁵ and the annual O&M cost is 4% of total wastewater capital expenditure. If such tariffs are implemented, projected revenues would cover 57% of estimated O&M costs in 2019, increasing to 140% by 2028.

10. **Solid-waste management – Kampot and Sihanoukville.** Benefits identified are reduced environmental pollution in the service areas, including in adjacent watercourses, groundwater, and the air. Surrogate values to quantify the economic benefits include solid-waste revenues and consumer surplus.

11. For Kampot, the WTP for solid-waste services is KR4,500 per household per month (which 73% of respondents were reportedly willing to pay), which is higher than the current solid-waste fee of KR4,000 collected by a private sector company. The solid-waste revenue projections assume the following: (i) tariffs increase 10% every 3 years starting in 2016; (ii) the number of customers increases 5% for residential and 5%–10% for other customers every year, such that the projected number of customers served is assumed to increase from 2,750 in 2016 to 4,706 in 2028;⁶ and (iv) annual O&M costs are estimated at 4% of capital expenditure.

⁴ The willingness of the beneficiary to pay for the services, above the existing or proposed tariff rates, is taken as the value of the consumer surplus. Consumer surplus is computed as follows: number of household customers (i.e., with project – without project) x (WTP / existing tariff – 1).

⁵ Based on the feedback of the water utility.

⁶ Based on the Kampot provincial government's plans and projections.

12. For Sihanoukville, the WTP for solid-waste services is KR4,000–KR7,000 per household per month (which 64% of respondents were reportedly willing to pay) compared to the current solid-waste fee of KR4,000 collected by a private sector company. Revenue projections assume (i) tariffs increase 15% every 3 years starting in 2016; (ii) the number of customers increases 5% for residential and 4% for other customers every year, from 3,949 in 2016 to 6,969 by 2028;⁷ and (iii) annual O&M costs are estimated at 4% of capital expenditure.

13. **Urban drainage – Kampot and Sihanoukville.** Better urban drainage will reduce flooding and potential economic losses and social disruption to residents and businesses. Benefits are estimated by quantifying and valuing the expected reduction in flood damage in the affected communities with the project. The estimated damage due to flooding per household or business establishment per year is KR1.44 million for Kampot,⁸ and for Sihanoukville the estimated damage due to flooding is KR2.24 million.⁹

14. **Direct beneficiaries.** Summary data for both cities are provided in Table 7.1.

Table 7.1: Direct Beneficiaries

Subproject	Component	Direct Beneficiaries			2028 Coverage (%)	Remarks
		2016 (non-incremental)	2016 to 2028 (incremental)	2028		
Kampot	Wastewater collection and treatment		15,204	15,204	40	persons
	Solid-waste management	2,750	1,956	4,706	58	customers
	Urban drainage		1,043	1,043		households
Sihanoukville	Solid-waste management	3,949	3,020	6,969	29	customers
	Urban drainage		3,220	3,220		households

Source: Project preparatory technical assistance consultant.

E. Economic Costs

15. Economic costs were derived from the estimates of capital and noncapital investments, replacement costs, and O&M costs in financial terms, and removing price contingencies, duties, and taxes and multiplying the net results by the conversion factors enumerated above in para.5. The weighted overall factors for capital costs and O&M costs were computed and applied to the net costs to derive the economic cost equivalents as summarized in Table 7.2.

Table 7.2: Summary of Economic Costs
(KR billion)

City	Subproject	Total Capital Cost	Annual O&M Cost
Kampot	Wastewater collection and treatment	9.21	1.47
	Solid-waste management	2.71	0.43
	Urban drainage	1.58	0.25
Sihanoukville	Solid-waste management	2.80	0.45
	Urban drainage	9.34	0.15

O&M = operation and maintenance.

Source: Project preparatory technical assistance consultant.

⁷ Based on the Sihanoukville provincial government's plans and projections.

⁸ Damage due to flood x frequency = KR0.48 million x 3.

⁹ Damage due to flood x frequency = KR0.56 million x 4.

F. Economic Internal Rate of Return and Sensitivity Analysis

16. The overall EIRR for Kampot and Sihanoukville is 15.1% for the base case and from 13.1% to 14.0% for the sensitivity tests (see Table 7.3). Summary results and detailed computations are shown in Tables 1–5 of the Supplementary Document.

Table 7.3: Overall Economic Viability Results

Item	NPV (KR million)	EIRR (%)	SV (%)
Base case	40.6	15.1	
Increase in capital investment (10%)	27.8	14.0	32
Increase in O&M (10%)	37.3	14.8	123
Decrease in benefits (10%)	20.6	13.6	-20
1-year delay in benefits	14.9	13.1	

EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance, SV = switching value.

Source: Project preparatory technical assistance consultant.

17. Given the stream of economic benefits and costs over the 25-year period, all subprojects are evaluated as economically viable since their EIRRs are higher than 12%. Table 7.4 summarizes the results of the base-case analysis and the sensitivity tests for the five subprojects.

Table 7.4: Economic Viability Results for Each Subproject

Scenario	KAMPOT						SIHANOUKVILLE			
	EIRR (%)	NPV (KN billion)	EIRR (%)	NPV (KN billion)	EIRR (%)	NPV (KN billion)	EIRR (%)	NPV (KN billion)	EIRR (%)	NPV (KN billion)
	Wastewater		Solid Waste Management		Urban Drainage		Solid Waste Management		Urban Drainage	
Base Case	14.5	9.0	18.1	6.5	16.2	1.4	13.9	1.9	14.3	4.8
10% Increase in Capital Cost	13.6	6.2	17.0	5.7	14.5	0.9	13.0	1.1	13.0	2.1
10% Increase in O&M Cost	14.3	8.2	17.9	6.3	15.8	1.2	13.7	1.7	14.1	4.4
10% Decrease in Benefits	13.3	4.5	15.9	4.8	14.0	0.6	12.7	0.7	12.6	1.2
1-Year Delay in Benefits	12.8	3.0	13.1	4.3	13.4	0.5	12.2	0.2	12.2	0.6
Switching Value-Capital Cost	32.0		82.0		30.0		23.0		18.0	
Switching Value-O&M Cost	113.0		282.0		101.0		79.0		121.0	
Switching Value-Benefits	(20.0)		(39.0)		(19.0)		(15.0)		(13.0)	

EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance.

Source: Project preparatory technical assistance consultant.

G. Distribution of Net Economic Benefits and Poverty Impact

18. The five subprojects are expected to generate total net economic benefits ranging from KR1.4 billion to KR16.9 billion.¹⁰ A significant portion of these will accrue to the solid waste, wastewater, and urban drainage beneficiaries, many of whom are residents in the subproject areas. A significant amount of person-days of local labor will be needed for physical construction, rehabilitation or replacement of the facilities, and their eventual operation. The government and/or the local economy will lose because of distortions in the exchange rate. The computed poverty impact ratios for the subproject varies from 4% to 58%. Summary results and detailed computations are shown in Tables 6–9 of the Supplementary Document.

¹⁰ Net economic benefit is the difference between the present value of economic benefits and financial revenues.