

## **ECONOMIC ANALYSIS**

1. Economic viability was assessed for the six subprojects proposed under the Greater Mekong Subregion East–West Economic Corridor Towns Development Project using preliminary design cost estimates and expected project scope and benefits. The methodology adopted in the evaluation was essentially in accordance with *Guidelines for the Economic Analysis of Projects* (1997) of the Asian Development Bank (ADB). Economic analysis involved (i) determining the economic viability of the investments, (ii) testing the impact of changes in key input variables on their viability, and (iii) analyzing the distribution and impact of economic benefits brought about by the investments to various stakeholders, particularly the poor.

2. The economic analysis of the subprojects was undertaken by computing the economic internal rate of return (EIRR) and net present value (NPV) from a stream of incremental benefits and costs attributable to the investments over 30 years. Using domestic price numeraire, economic costs were derived from the financial estimates of investments including physical contingencies. Taxes and duties were deducted from the financial costs, segregated into tradable and nontradable components, then shadow priced using the following conversion factors: shadow exchange rate factor of 1.1, shadow wage rate factor for unskilled labor of 0.75, and a factor of 1.0 for nontradable components.

3. Economic benefits, on the one hand, were identified for each subproject; however, only those that are readily quantifiable were included in the computation of the EIRR and NPV. Sensitivity analyses were undertaken to test the robustness of the subprojects to various changes in assumptions.

### **A. Wastewater Treatment**

4. A wastewater treatment subproject is proposed for the town of Kaysone Phomvihane. The subproject will provide a reticulated sewerage system in three areas and a treatment plant that will use the stabilization pond process. This treatment process is considered the least-cost solution compared with other wastewater treatment technologies. It is suitable for Kaysone Phomvihane as land cost is relatively low and skilled technicians are rare. It has the advantage of low capital and minimum skills required for its operation.

5. The appraisal report shows that Kaysone Phomvihane has an existing wastewater system with very limited coverage. The construction of the subproject will remove the service limitations and enable more households and business establishments to be connected to the sanitary facility. The subproject will have considerable health benefits for the residents. Quantifiable economic benefits from the wastewater system include savings from medical costs due to reduced sanitation-related health problems. Another benefit used in the evaluation includes target beneficiaries' willingness to pay since this represents the perceived benefits that can be derived from the project. The evaluated EIRRs range from 17.6% to 27.1% for the base cost and the sensitivity analyses testing various scenarios.

### **B. Urban Roads**

6. Three urban road subprojects are proposed in the following corridor towns: Kaysone Phomvihane, Phine, and Dansavanh. All three subprojects will improve selected main and lateral roads and drainage. Growth has brought physical development and employment to these emerging economic corridor towns. If the trend continues, existing infrastructure will need to be improved. The problem will become more acute with increasing investment in the areas.

7. The EIRR for the subprojects were calculated by comparing the with- and without-project scenarios for the subproject roads. In the without-project scenario, the road is assumed to receive only minimal maintenance and continue to deteriorate. The with-project scenario includes routine and periodic maintenance according to international standards. Without the project, the traffic volume would exceed the capacity of the roads in the near future. The roads would become congested—leading to increases in travel time and vehicle operating costs. With the project, travel time will be reduced because of higher speeds; vehicle operating costs will be reduced because of the faster and smoother ride on the subproject road.

8. The EIRRs range from 12.4% to 35.2%. Sensitivity analyses were undertaken to test the robustness of the analysis and the consequences of changes in variables. All EIRRs remain over 12% and the plausible ranges of variability of the tested parameters and variables are well within the switching values calculated under the sensitivity tests, indicating the economic viability of the subproject.

### **C. Solid Waste Management**

9. A solid waste management subproject in Kaysone Phomvihane includes the development of a sanitary landfill and composting facility, and procurement of collection equipment to improve the waste collection system.

10. The subproject will directly benefit approximately 80% of the population of Kaysone Phomvihane. The appraisal report shows that the existing collection system covers only 20% of the town. Implementation of the proposed improvements will remove the service limitations and enable more households and business establishments to receive efficient waste collection and a disposal facility. Quantifiable economic benefits from the solid waste management system include willingness to pay of the intended beneficiaries. The willingness to pay represents the perceived economic benefits that beneficiaries assume they will get from the subproject.

11. The subproject will also generate health benefits for local residents and environmental benefits such as the preservation and conservation of environment and species. However, these benefits are not included in the analysis due to difficulties in valuation and lack of data.

12. The evaluated EIRR ranges from 13.3% to 16.9% for the base cost and the sensitivity analyses testing various scenarios.

### **D. Mekong River Embankment Protection**

13. This priority urban environmental infrastructure subproject aims to rehabilitate a section of the Mekong River embankment that it is protected from erosion and can facilitate local economic activities, trading, restaurants, and traditional festivals and contribute to making Kaysone Phomvihane an attractive and competitive town along the East–West Economic Corridor. The subproject will involve the construction of an expanded area of riverbank erosion protection extending from the existing bank to 50 meters over an 800 meter-long section.

14. The economic feasibility of the investments was assessed over 30 years in terms. Quantifiable economic benefits from the flood control protection include increase in land value with the completion of the subproject. This is used as a proxy indicator for the benefits attributable to the project. The evaluated EIRR ranges from 12.3% to 15.6% for the base case and the sensitivity analyses testing various scenarios.

## **E. Materials Recovery Facility**

15. For the proposed materials recovery facility in Kaysone Phomvihane, the basic assumption is that the subproject will lead to higher recovery of compostable and recyclable materials through the establishment of a more efficient recovery scheme. The system is likewise expected to promote sanitary collection, recovery, and transport of compost and recyclables and prolong the life of the disposal facility with the reduction of residual wastes.

16. Overall, the facility is expected to recover a daily average of 2–5 tons of recyclables, and to process a weekly average of 25 kilograms of compost. To value these benefits, the revenue to be derived from the operation of the facility is used as a proxy value of the economic efficiency of recovering waste, which actually adds to the overall local economy. An additional benefit is expected from the reduction in costs of disposal or savings in disposal cost with the extension of the life of the disposal facility. The evaluated EIRR ranges from 27.2% to 22.4% for all scenarios tested.

17. The results of economic analyses and sensitivity tests are presented in Table 1.

## **F. Distributional Analysis**

18. The purpose of the distribution analysis is to show how the benefits of the subprojects are distributed to different groups of stakeholders. In this case, the groups include users (both domestic and commercial), labor, and the government.

19. The difference of the discounted economic benefits is distributed among these groups. The amount of net benefits to the poor is average, which was expected, considering that the subprojects indirectly address local poverty by facilitating economic development in the area, creating more employment opportunities, and improving access to sanitation facilities. The summary result of the benefit distribution and poverty impact analysis is presented in Table 2.

**Table 1: Summary Indicators: Base Case and Sensitivity Analysis**

<b>Subproject, Scenario</b>	<b>EIRR (%)</b>	<b>NPV (\$ million)</b>	<b>BCR</b>	<b>SV (%)</b>
<b>1. Kaysone Phomvihane Wastewater Treatment</b>				
Base case	27.1	1.95	1.78	-
10% increase in capital, O&M costs	22.7	1.41	1.62	61
10% reduction in returns or benefits	22.2	1.21	1.60	55
10% increase in costs, 10% reduction in benefits	17.6	0.67	1.46	28
1-year delay in benefits	18.9	1.15	1.78	33
<b>2. Kaysone Phomvihane Urban Roads</b>				
Base case	18.5	75.40	6.52	-
10% increase in capital, O&M costs	17.3	74.00	5.93	154
10% reduction in returns or benefits	17.2	66.50	5.87	140
10% increase in costs, 10% reduction in benefits	16.0	65.10	5.34	75
<b>3. Kaysone Phomvihane Solid Waste Management</b>				
Base case				
10% increase in capital, O&M costs	16.9	0.76	1.96	-
10% reduction in returns or benefits	15.2	0.52	1.78	98
10% increase in costs, 10% reduction in benefits	15.0	0.45	1.76	89
1-year delay in benefits	13.3	0.21	1.60	48
	14.4	0.40	1.94	67
<b>4. Kaysone Phomvihane Mekong River Embankment Protection</b>				
Base case	15.6	23.44	4.57	-
10% increase in capital, O&M costs	14.0	22.78	4.15	97
10% reduction in returns or benefits	13.8	20.44	4.11	88
10% increase in costs, 10% reduction in benefits	12.3	19.78	3.74	48
<b>5. Kaysone Phomvihane Materials Recovery Facility</b>				
Base case	29.0	0.58	3.29	-
10% increase in capital, O&M costs	26.8	0.54	2.99	128
10% increase in capital, O&M costs	26.5	0.49	2.96	116
10% reduction in returns or benefits	24.4	0.45	2.69	63
10% increase in costs, 10% reduction in benefits	23.7	0.42	3.08	56
1-year delay in benefits				
<b>6. Phine Urban Road</b>				
Base case	31.8	101.07	12.91	-
10% increase in capital, O&M costs	29.9	100.22	11.74	165
10% reduction in returns or benefits	29.7	90.11	11.62	150
10% increase in costs, 10% reduction in benefits	27.9	89.27	10.57	81
<b>7. Dansavanh Urban Road</b>				
Base case	27.3	45.36	10.22	-
10% increase in capital, O&M costs	25.7	44.87	9.29	167
10% reduction in returns or benefits	25.5	40.33	9.20	152
10% increase in costs, 10% reduction in benefits	24.0	39.84	8.36	81

( - ) = not applicable, BCR = benefit–cost ratio, EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance, SV = switching value.

Source: Asian Development Bank estimates.

**Table 2: Benefit Distribution and Poverty Impact Ratio**

<b>Subprojects</b>	<b>City Residents</b>	<b>Business</b>	<b>Labor</b>	<b>Government</b>	<b>Total</b>
<b>Kaysone Phomvihane Wastewater Treatment</b>					
Gains and losses	8.52	3.50	0.87	(0.68)	12.21
Distribution (%)	69.8	28.7	7.1	(5.5)	100.0
Proportion of poor (%)	23.0	23.0	50.0	-	-
Benefits to poor	1.96	0.81	0.43	-	3.20
Poverty impact ratio (%)					26.0
<b>Kaysone Phomvihane Urban Road</b>					
Gains and losses (\$ million)	33.63	50.45	0.67	(0.63)	84.11
Distribution (%)	40.0	60.0	0.8	(0.8)	100.0
Proportion of poor (%)	50.0	20.0	50.0	-	-
Benefits to poor (\$ million)	16.92	10.19	0.34	-	27.44
Poverty impact ratio (%)					33.0
<b>Kaysone Phomvihane Solid Waste Management</b>					
Gains and losses (\$ million)	2.06	1.37	0.06	(0.12)	3.37
Distribution (%)	61.1	40.7	1.8	(3.6)	100.0
Proportion of poor (%)	50.0	25.0	50.0	-	-
Benefits to poor (\$ million)	1.03	0.34	0.03	-	1.41
Poverty impact ratio (%)					42.0
<b>Kaysone Phomvihane Mekong River Embankment Protection</b>					
Gains and losses (\$ million)	2.85	2.85	0.41	(0.33)	5.78
Distribution (%)	49.0	49.0	7.0	(6.0)	100.0
Proportion of poor (%)	50.0	20.0	50.0	-	-
Benefits to poor (\$ million)	1.43	0.57	0.20	-	2.21
Poverty impact ratio (%)					38.0
<b>Kaysone Phomvihane Materials Recovery Facility</b>					
Gains and losses (\$ million)	0.72	0.72	0.09	0.01	1.55
Distribution (%)	47.0	47.0	6.0	1.0	100.0
Proportion of poor (%)	52.0	20.0	52.0	-	-
Benefits to poor (\$ million)	0.38	0.14	0.05	-	0.57
Poverty impact ratio (%)					37.0
<b>Phine Urban Road</b>					
Gains and losses (\$ million)	50.60	75.89	0.40	(0.25)	126.63
Distribution (%)	40.0	60.0	0.3	(0.2)	100.0
Proportion of poor (%)	58.0	20.0	58.0	-	-
Benefits to poor (\$ million)	29.24	15.33	0.23	-	44.80
Poverty impact ratio (%)					35.0
<b>Dansavanh Urban Road</b>					
Gains and losses (\$ million)	9.15	13.72	0.24	(0.16)	22.94
Distribution (%)	40.0	60.0	1.1	(0.7)	100.0
Proportion of poor (%)	57.0	20.0	57.0	-	-
Benefits to poor (\$ million)	5.18	2.77	0.14	-	8.08
Poverty impact ratio (%)					35.0

( - ) = not applicable, ( ) = negative value.

Source: Asian Development Bank estimates.