Economic Feasibility Study

1. Overview

Feasibility study is to estimate and compare the project cost and operating costs required for the project with the economic benefits expected to determine whether the economic benefits exceed the costs.

Non-measurables like social benefits and costs should be considered as well as economic benefits and costs when practicing feasibility study. However, in this analysis, the feasibility study is assessed through Project IRR and B/C Ratio analysis excluding these non-measurables into consideration since it is difficult to quantify them**.**

1.1. Basis of The Feasibility Study

A. Premise

- Construction Period : Jan.2023 ~ Jun.2023 (6months)
- Operation Period : Jul. 2023 ~ Jun. 2043 (Assumed 20 years of operation period)

B. Estimate of The Project Costs and Operating Expenses

- The project costs include construction costs, incidental costs, and reserves for sewage reuse and grey water recycle. The operating expenses include labor expenses, power expenses, general expenses, and maintenance expenses of each facility.

C. Estimate of Benefit

- Measurable benefits from the project are estimated water supply revenues.

D. Inflation

- Inflation rate of 3% was applied to water supply and the operating expenses.

E. Exchange rate

- 1 USD=1,085.30 KRW as of December 09, 2020 was applied.

2. Feasibility Study for Sewage Reuse

2.1. Estimated the Total Investment Costs and Financing Structure

A. Estimate of the Total Investment Costs

- The total project costs including construction costs and transportation fares were estimated at 5,678,614 USD and the total investment costs including reserves for changes in CPI were estimated at 6,091,633 USD.

Table 1. Breakdown of the Total Investment Costs

(Units : USD)

Category	Amount	Ratio (%)	Notes
Construction Costs	5,623,330	92.3%	
Incidental Costs	55,284	0.9%	Transportaion fare
Reserves	413,019	6.8%	Inflation rate
Total Investment Costs	**6,091,633**	**100.0%**	

Table 2. Breakdown of construction cost by facility

(Units : USD)

Category	Amount	Ratio	Notes
Facility	961,025	17.1%	
Pipeline	4,662,305	82.9%	
total	**5,623,330**	**100.0%**	

B. Financing Structure

- This project was designed to be financed by public sector only.

Table 3. Quarterly Financing Plan

(Units : USD)

Category	Total	Q1,2023	Q2,2023	Ratio	Notes
Public Sector	6,091,633	3,034,563	3,057,070	100.00%	
Private Sector	-	-	-	-	
Total	**6,091,633**	**3,034,563**	**3,057,070**	**100.00%**	

2.2. Estimate of Revenues and Operating Expenses

A. Estimate of the Revenues

- Revenues in this project consist of the revenues from water supply
- Sales price was used to making up for the operating expenses.
- The total estimated revenues during the operation period was 745,823 USD and the average annual revenues during the operation period is 37,291 USD.

Table 4. Basic Assumption for the Revenues

Category	Water Supply	Days	Sales Price	Inflation
Water Supply	100.0ton/day	365days	0.69 USD/ton	3.0%

B. Estimate of the Operating Expenses

- The operating expenses are consisted of labors, electricity, general expenses and maintenance and repair costs.
- Annual inflation rate of 3% was applied.

Table 5. Breakdown of the Operating Expenses

(Unit : USD/year)

Category	Amount	Ratio	Notes
Labor	553	2.2%	2020 Constant Price
Electricity	-	-	
General Expenses	18,944	75.7%	
Maintenance & Repair	5,528	22.1%	
Total	**25,026**	**100.0%**	

- The total operating expenses occurring from the facilities during the operation period were estimated at 745,823 USD. Labor expenses account for 2.2%, general expenses 75.7% and maintenance and repair costs 22.1% of the total.

Table 6. Projected Cash Flow

(Units : 1,000 USD)

Item	Total	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
I. Total Project Cost	6,091.6	6,091.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II.Operating Expenses	745.8	13.7	28.2	29.0	29.9	30.8	31.7	32.7	33.6	34.6	35.7	36.8	37.9	39.0	40.2	41.4	42.6	43.9	45.2	46.6	48.0	24.7
Cash Outflow (I+II)	6,837.5	6,105.3	28.2	29.0	29.9	30.8	31.7	32.7	33.6	34.6	35.7	36.8	37.9	39.0	40.2	41.4	42.6	43.9	45.2	46.6	48.0	24.7
III.Sales	745.8	13.7	28.2	29.0	29.9	30.8	31.7	32.7	33.6	34.6	35.7	36.8	37.9	39.0	40.2	41.4	42.6	43.9	45.2	46.6	48.0	24.7
IV.Financial Aid	6,091.6	6,091.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cash Inflow(III+IV)	6,837.5	6,105.3	28.2	29.0	29.9	30.8	31.7	32.7	33.6	34.6	35.7	36.8	37.9	39.0	40.2	41.4	42.6	43.9	45.2	46.6	48.0	24.7
Net Cash Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2.3. Economic Feasibility Study

A. Basic Assumptions for Economic Feasibility Study

- Basic assumptions for economic feasibility study are as follows.

Table 7. Basic assumptions

Category		Description
Project Duration	Reference date	Jan 1, 2020
	Construction period	6 months (Jan. ~ Jun. 2023)
	Operating period	20 years (Jul. 2023 ~ Jun. 2043)
	Operation Days in a Year	Water Supply : 365 days
Total Investment Costs	Total Project Costs	5,678,614 USD
	Total Investment Costs	6,091,633 USD
Financing Structure	Funding ratio	Public Sector : 100.0 %
		Private Sector : -
Revenues and Expenses	Operating Revenues	Water supply: 0.69 USD/ ton
	Operating Expenses	Labor cost, electric power cost, general expense, maintenance cost
Others	Corporate Tax	32.0%(single tax rate)
	Inflation Rate	3.0% assumed
	Exchange Rate	KRW/USD = 1,085.30 assumed

B. B/C Ratio Analysis

- The unit price of water supply at the level that can cover the operating expenses of this project was calculated at 0.69 USD/Tone, and the B/C Ratio at that price level was calculated at 1.00 on both before-tax and after-tax basis.

Table 8. B/C Ratio

Category	Before Tax	After Tax
B/C Ratio	1.00	1.00

3. Feasibility Study for Greywater Recycling

3.1. Estimate of the Total Investment Costs and Financing Structure

A. Estimate of the Total Investment Costs

- The total project cost including construction cost, transportation fare was estimated 4,902,331 USD and the total investment cost including contingency (price index) and construction was estimated at 5,285,889 USD.

Table 9. Breakdown of the Total Investment Costs

(Units : USD)

Category	Amount	Ratio	Notes
Construction	4,718,050	89.7%	
Incidental	184,281	3.5%	Transport Fare
Reserves	356,558	6.8%	Inflation rate
Total Investment Costs	**5,258,889**	**100.0%**	

Table 10. Breakdown of the Construction Costs by Facility

(Units : USD)

Category	Amount	Ratio	Notes
Facility	4,718,050	100.0%	
Total	**4,718,050**	**100.0%**	

B. Financing Structure

- This project was designed to be financed by public sector only.

Table 11. Quarterly Financing Plan

(Units : USD)

Category	Total	Q1,2023	Q2,2023	Ratio	Notes
Public Sector	5,258,889	2,619,729	2,639,160	100.00%	
Private Sector	-	-	-	-	
Total	**5,258,889**	**2,619,729**	**2,639,160**	**100.00%**	

3.2. Estimate of the Revenues and Operating Expenses

A. Estimate of the Revenues

- Revenues in this project consist of the revenues from water supply.
- Sales price was used to making up for the operating expenses.
- Estimated sales during the operation period was 2,224,955 USD and the average annual sales during the operation period is 111,248 USD.

Table 12. Basic Assumptions for the Revenues

Category	Water supply	Days	Sales Price	Inflation
Water Supply	500ton/days	365days	0.41USD/ton	3.0%

B. Estate of the Operating Expenses

- The operating expenses consist of labors, electricity, general expenses and maintenance and repair costs.
- Annual inflation rate of 3% was applied.
- The total operating expenses occurring from the facilities during the operation period were estimated at 2,224,955 USD. In detail, labor expenses account for 22.2%, general expenses 59.3% and maintenance and repair costs 18.5% of the total.

Table 13. Breakdown of the Operating Expenses

(Units:USD)

Category	Amount	Ratio	Notes
Labors	16,585	22.2%	2020 Constant Price
Electricity	-	-	
General Expenses	44,251	59.3%	
Maintenance & Repair	13,821	18.5%	
Total	**74,657**	**100.0%**	

Table 14. Projected Cash Flow

Item	Total	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
ITotal Project Costs	5,258.9	5,258.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II.Operating Expenses	2,225.0	40.8	84.0	86.5	89.1	91.8	94.6	97.4	100.3	103.3	106.4	109.6	112.9	116.3	119.8	123.4	127.1	130.9	134.8	138.9	143.1	73.7
Cash Outflow(I+II)	7,483.8	5,299.7	84.0	86.5	89.1	91.8	94.6	97.4	100.3	103.3	106.4	109.6	112.9	116.3	119.8	123.4	127.1	130.9	134.8	138.9	143.1	73.7
III.Sales	2,225.0	40.8	84.0	86.5	89.1	91.8	94.6	97.4	100.3	103.3	106.4	109.6	112.9	116.3	119.8	123.4	127.1	130.9	134.8	138.9	143.1	73.7
IV.Financial aid	5,258.9	5,258.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cash Inflow(III+IV)	7,483.8	5,299.7	84.0	86.5	89.1	91.8	94.6	97.4	100.3	103.3	106.4	109.6	112.9	116.3	119.8	123.4	127.1	130.9	134.8	138.9	143.1	73.7
Net Cash Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3.3. Economic feasibility analysis

A. Basic assumptions for economic feasibility analysis

- Basic assumptions for economic feasibility analysis are as follows

Table 15. Basic Assumption

Category		Description
Project Duration	Reference date	Jan 1, 2020
	Construction period	6 months (Jan. ~ Jun. 2023)
	Operating period	20 years (Jul. 2023 ~ Jun. 2043)
	Operation Days in a Year	Water supply : 365 days
Total Investment Costs	Total Project Costs	4,902,331 USD
	Total Investment Costs	5,258,889 USD
Financing	Funding Ratio	Public sector : 100.0 %
		Private sector : -
Revenue and cost	Revenues	Water supply: 0.41 USD/ ton
	Operating Expenses	Labor cost, electric power cost, general expense, maintenance cost
Other assumptions	Corporate Tax	32.0%(single tax rate)
	Inflation Rate	3.0% assumed
	Exchange Rate	KRW/USD = 1,085.30 assumed

B. Analysis of B/C ratio

- The unit price of water supply at the level that can cover the operating expenses of this project was calculated at 0.41 USD/m^3, and the B/C Ratio at that price level was calculated at 1.00 on both before-tax and after-tax basis.

Table 16. B/C Ratio

Category	Before Tax	After Tax
B/C Ratio	1.00	1.00