ISSN No:-2456-2165

Feasibility Analysis Offtake CANDI from the UMBULAN Drinking water Supply System

Wahyudin, Christiono Utomo, Rianto B. Adihardjo, Aditya Sutantio
Manajemen Proyek, Magister Manajemen Teknologi, Institut Teknologi Sepuluh Nopember
Jl. Cokroaminoto 12A Surabaya - 60264

Abstract:- SPAM (Water Supply System) Umbulan is an alternative source for Regional Water Company (PDAM) of Sidoarjo Regency in terms of fulfillment of drinking water needs. PDAM Kabupaten Sidoarjo representing the Government of Sidoarjo Regency entered into a cooperation contract on the distribution of bulk drinking water of 1,200 liters / second with the Regional Water Company (PDAB) of East Java Province. In the contract there is offtake (supply point) Candi as one of supply point in Umbulan SPAM line with capacity of 200 liter / second, distribution length along 261 km and total investment value reach 200 billion rupiah. To meet the investment needs of loan capital is required because PDAM Kabupaten Sidoarjo do not have enough budget. Investment feasibility analysis is required to ensure the feasibility of project investment. Investment feasibility analysis is conducted through the stages of secondary data collection and primary data to identify cost factors and income factors. The method approach used is the calculation of investment feasibility by calculating NPV and IRR and sensitivity analysis. The expected results of the investment feasibility analysis is to be able to determine the feasibility of investment to be made on the project offtake Candi from SPAM Umbulan.

Keywords:- *Sensitivity Analysis, Investment Feasibility, IRR, NPV, Offtake, SPAM .*

I. INTRODUCTION

Water is one of the environmental elements that are needed by humans, animals and plants. Without water we have difficulty maintaining life on earth. Currently, the need of water is increasing. This fact can not be denied, given the increasing population and living standards of the community as well.

With the absolute necessity of this water causes people always try to get it by all means and low cost. In addition drinking water standards must also meet requirements such as quality, quantity and continuity. To obtain a qualified water source or at least qualify after it is processed first, it often comes from locations so far from residential / consumer. The problem of remote clean water sources from these consumers can be overcome by making a network or piping system connecting water sources with consumers. This piping system is better known as Drinking Water Supply System (DWSS or called SPAM in Indonesian language).

The local government is obliged to provide drinking water for the community. The existence of the Public Private Partnership Project (PPP) of Umbulan Drinking Water Supply System (SPAM) is inseparable from the high demand for quality water sources for East Java communities, especially in the regencies and cities of Pasuruan, Sidoarjo, Surabaya and Gresik . On the other hand, there is a source of quality Water that is very feasible to be used as a source of drinking water that meets the criteria of drinking water set by the Ministry of Health, with abundant water debit, which reaches 4,000 liters / sec. Umbulan Water Supply System has a transmission system of 93 km and 16 Offtake or supply point to 5 (five) regencies / municipalities.

Still part from the Umbulan's overall contract, a cooperation agreement on water utilization between the East Java Provincial Government and the Government of Sidoarjo Regency was followed up by a contract between the Sidoarjo Regional Water Company (PDAM) with the Regional Water Company of East Java on bulk drinking water supply of 1,200 liters / second of total Umbulan SPAM production. The agreement is in line with the Sidoarjo district government's SPAM master plan for alternative sources of raw water other than surface water since in Sidoarjo district to date only depends on surface water for its water treatment plant.

II. CONCEPTUAL BACKGROUND

Surface water or river water is the main source of raw water in Sidoarjo regency because the district of Sidoarjo is a delta area that does not have springs as well as highland areas. So that s wahy the Umbulan is very meaningful as alternative source of raw water in Sidoarjo regency.

Offtake Candi is one of 8 offtake in Sidoarjoregency. Plan of service coverage offtake Candi has the supply capacity according to cooperation agreement between PDAM with PDAB that is 200 liter / second and distribution length as far as 261 km. Offtake System This Candi includes 5 districts, among others; district of Candi, Sidoarjo sub-district, Tanggulangin sub-district, Tulangan district and Wonoayu sub-district. The investment value for the Candi offtake service pipeline distribution reaches 200 billion rupiah.

ISSN No:-2456-2165

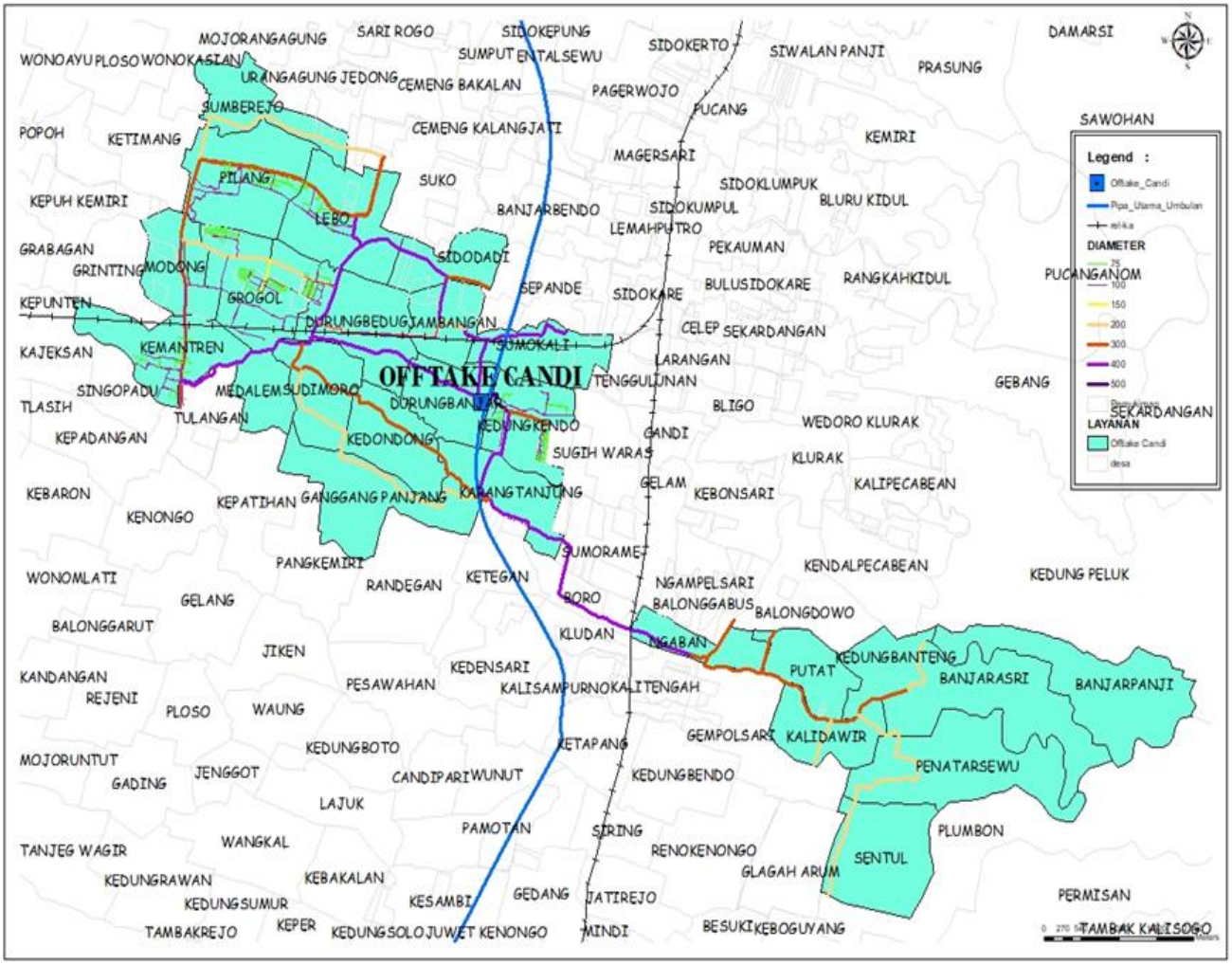

Fig 1:- Coverage area of Offtake Candi

Offtake Candi is one of eight absorption points that has a capacity of 200 liter / sec. If 1 unit of house connection consists of 6 people and clean water requirement for 1 person per day as much as 180 liters then the water discharge of 1 liter / second can be enough for 80 home connections. So that the water capacity of umbulan in the Temple offtake of 200 liters / sec is able to meet the water needs of 16,000 units of House Connection (SR) or equal to 96.000 inhabitants.

The service of distribution pipeline from offtake This Candi includes 5 districts and consists of 25 villages. The service areas of the 5 sub-districts are; district of Candi, Tanggulangin sub-district, Sidoarjo sub-district, Tulangan district and Wonoayu sub-district. For the temple district covers 7 villages from a total of 24 villages namely; Durungbanjar village, Durungbedug village, Jambangan village, Karangtanjung village, Kedungkendo village, Sidodadi village and Sumokali village. Sidoarjo sub-district covers only 1 village out of a total of 24 villages, Lebo village. Tanggulangin sub-district covers 9 villages out of a total of 19 villages; Banjar Asri village, Banjar Panji village, Ganggang Panjang village, Kalidawir village, Kedungbanteng village, Ngaban village, Penatarsewu village, Putat village and Sentul village. Tulangan District covers 6 villages out of a total of 22 villages; Grogol village, Modong village, Sudimoro village, Medalem village, Kedondong village and Kemantren village. Wonoayu Sub-district covers 2 villages out of 22 villages; Sumberejo village and Pilang village.

- *Research Position*

The research positions that distinguish the previous research are:

1. The research object is different from the previous research that is investment project offtakeCandi from Umbulan SPAM.
2. The study conducted on the object of research is the feasibility analysis of the project investment offtake Candi.
3. Investment feasibility analysis is done with consideration of the composition of own capital and loan capital as well as the size of the interest rate of the loan, which then calculated NPV and IRR in investment offtake Candi project.
4. Test the sensitivity to the increase of cost value and decrease of income to know sensitivity of feasibility limit of investment of project offtake Candi.
5. The purpose of this study was conducted to determine the limits of how feasible to be done or not done to investment project offtake Candifrom UmbulanS PAM

ISSN No:-2456-2165

CLASSIFICATION	BACKGROUND			METHODOLOGY	OBJECT	EXPECTED RESULTS
	COVERAGE	PROBLEM	AIM			
The investment feasibility offtake Cando from Umbulan Water Supply System (SPAM)	Composition of own capital and loan capital	What factors are the charges on the offtake Candi	Know the cost factor on the offtake Candi	Data collection techniques primary and secondary	System service offtake Candi of SPAM Umbulan covering 25 villages from 5 districts in Sidoarjo district.	The cost factor on the offtake Candi
	The magnitude of NPV and IRR value on project investment	What factors are the income on the offtake Candi	Know the income factor at the offtake Candi	Data collection techniques primary and secondary		The revenue factor on the offtake Candi
	Sensitivity test on the number of customer absorption, non revenue water level, Increase in bulk water rates and increase in the value of operational costs	How feasible investment on the offtake Candi project	Knowing the feasibility of investment offtake Candi	NPV analysis, IRR and sensitivity analysis		The investment feasibility offtake Candi

Tabel 1. Research Position

III. METHOD

Research method is step and procedure that will be done to reach goal and get answer to problem in research. These steps and procedures are the embodiment of the research mindset.

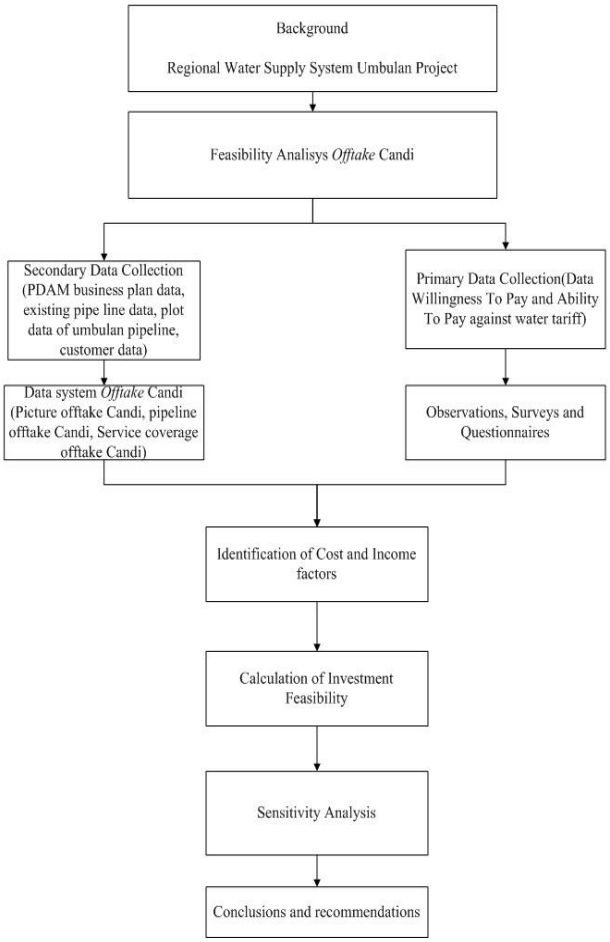

Figure 2 Flow Chart of Research

The stages of the stages of activity in this study originated from the background of the Umbulan Regional Water Supply System project in East Java as an alternative source solution in terms of addressing the problem of shortage of clean water supply in urban areas including Sidoarjo Regency. Umbulan main distribution pipe with a diameter of 1,000 mm mounted on the shoulder of road along the Bangil-Gempol-Sidoarjo-Surabaya-Gresik expressway.

An investment feasibility analysis of the offtake Candifrom Umbulan Water Supply System is required. So that the expected results will be obtained limits - limits offtake feasibility of the Temple so that the limit on what the project offtake Candi is feasible or not to do.

The next stage of data collection is divided into two namely; Secondary data collection and Primary data collection. Secondary data consists of; PDAM business plan data, existing pipeline data, Umbulan line data plan, customer data, resident data, electricity rayon data from PLN. Secondary data is also collected from the data system offtake Temple starting from the image offtake Candi, pipeline and pipe dimension, Coverage service offtake Candi uptake. Primary Data as a reinforcement for the determination of water tariffs applied to prospective customers. Primary data also consider Willingnes To Pay (WTP) factor is the willingness of prospective customers to issue rewards for services obtained and Ability To Pay (ATP) is the ability of prospective customers to pay services received by income. Primary data collection by field observation method in terms of viewing the condition of the pipeline plan. Then the survey method with questionnaires to prospective devices related to their response about WTP and ATP to the tariff of water that will be applied. It is hoped that the collection of secondary and primary data can support further analysis.

After the data collected then identified what factors are the source of cost when the construction offtake Temple. And identify what factors can generate income after the construction offtake Temple done.If the cost factor and income factor can be identified then it can be done the calculation of investment feasibility to find out how much capital needed in the construction offtake Temple. In the calculation of investment feasibility can be known the value of NPV and IRR.

The results of the calculation of investment feasibility will be tested again in the phase of Sensitivity Analysis to measure the sensitivity of the feasibility limit of investment if there is a change to a variable value that influences. Factors to be tested for their sensitivity levels include; rising costs that lead to rising investment value, the least amount of customer uptake that can lead to a decrease in the number of sales that resulted in lower revenue.From a series of research lines made conclusions on the results of

ISSN No:-2456-2165

research and made suggestions for refinement of further research.

IV. RESULTS AND DISCUSSION

The potential of Sidoarjo residents served by the system offtake Candi amounted to 36,646 families (Family Head) with a ratio of family members of 4 for each family.According to the calculation of the normal water requirement of 180 liters / person / day, it is valid for 1 unit of house connection with 6 souls then the water discharge 1 liter / second can be enough for 80 home connections. But the population data found in Sidoarjo shows the ratio of the number of family members an average of 3.36 so taken rounding into 4 which means each family consists of 4 people. So that the water capacity of umbulan in the Temple offtake of 200 liters / sec is able to meet the water needs of 24,000 units of House Connection (SR) or equal to 96,000 inhabitants.

A. Cost

Total Cost Rp 200.000.000.000, - for financing year 0.

NO	COST CATEGORY	DETAILS ITEM COSTS	AMOUNT (Rp)
1	Design Cost	Survey and Engineering Design	**2,000,000,000**
2	Permit cost	Licensing of Public Utilization of PU Bina Marga Street	200,000,000
3		Licensing of Public Utilization of Public Roads of PU Bina Marga Province	200,000,000
4		Licensing Utilization of Public Space PU PR Sidoarjo Regency	200,000,000
5		Licensing of PT KAI's Owned Space Utilization	100,000,000
6		Licensing of Space Utilization Owned by PT JASA MARGA	100,000,000
7		Socialization Cost	25,000,000
8	Land Reservoir Land Release Cost 20 m x 30 m (600 m2)		3,000,000,000
9	Construction Cost	Cost of Work Preparation	70,400,000
10		Cost of Procurement & Installation Work of Distribution Pipe	94,731,292,000
11		Cost of Procurement & Installation of Pipe Accessories	704,761,000
12		Cost of Groundwork, Land & Recycling Asphalt Road	179,852,000
13		Cost of Groundwork, Land & Recycling Roadside	54,632,242,000
14		Horizontal Directional Drilling Toll Road Works (HDD)	360,000,000
15		Crossing Roads of Train (Jacking)	968,000,000
16		River Crossing Works (Pipe Bridge)	416,036,000
17		Hydrostatic Test Works on pipes network	443,360,000
18		Ground Reservoir Development Work and Supporting Building	7,669,057,000
19		Employment costs Procurement & installation of 24,000 units of House Connections (Customers)	34,000,000,000
	SUB TOTAL		**200,000,000,000**

Tabel 2. Total Cost

B. Income

Revenues come from two categories: Non-water revenue and water revenues. The intended non-water revenue is revenue that is not from water sales but from the recipient of the new subscription connection received from the customer when making a new installation.Assuming the entire amount of potency in the service offtake Candi do a new tide then non-water revenue can be calculated as shown in Table 3 as follows ;

NO	INCOME ITEMS	VOLUME	UNIT PRICE (Rp)	AMOUNT (Rp)
1	Non-water Payment Receipts (Subscription Connection) class II D	24,000	1,500,000	36,000,000,000
2	Non-water Payment Receipts (Subscription Connection) class III C	342	2,735,000	935,370,000
3	Non-water Payment Receipts (Subscription Connection) class III F	22	8,200,000	180,400,000
				37,115,770,000

Tabel 3. Non-water Revenue

While the intended income of water is income from sales of clean water distributed to the service area. It is assumed that the entire amount of potency in the service offtake Candi consume water then the water income can be calculated as shown in table 4 as follows;

GROUP	CATEGORY	CLASS CUSTOMER	Number of Connections	Water Usage (m3/Month/SL)	Water Usage (m3/Month)	Water Usage (m3/Year)	Composition (m3)	PROGRESSIVE USE (M3)	WATER DRINK TARIFF (Rp)	AMOUNT (Rp/Month)	AMOUNT(Rp/Year)
II	DOMESTIK	D	24000	20	480,000	5,760,000	10	0 - 10	3,400	816,000,000	9,792,000,000
							10	11 - 20	5,600	1,344,000,000	16,128,000,000
							-	21 - 30	7,600	-	-
							-	diatas 30	8,700	-	-
III	INDUSTRI	C	342	30	10,260	123,120	20	0 - 20	8,800	60,192,000	722,304,000
							10	21 - 30	10,000	34,200,000	410,400,000
							-	diatas 30	10,900	-	-
		F	22	40	880	10,560	20	0 - 20	10,600	4,664,000	55,968,000
							10	21 - 30	11,900	2,618,000	31,416,000
							10	diatas 30	12,700	2,794,000	33,528,000
		Total	24,364		491,140	5,893,680				2,264,468,000	27,173,616,000

Tabel 4. Water Revenue

ISSN No:-2456-2165

C. MARR

PDAM Kabupaten Sidoarjo as a local owned company that is oriented to corporate profits and social services, so in investing MARR (Minimum Attractive Rate of Return) company maximum 10%.

D. Cash Out and Cash In

To build offtake Candi required capital for the financing of the initial construction. The cost in year 0 is different from the cost in year 1, year 2 and so on. In the year 0 it consists of early exemption and construction costs. In the 1st year, the cost of purchasing 100 liters / sec bulk water along with the operational cost and maintenance of the system was started. New in the 2nd year onwards the cost of purchasing bulk water increased its capacity to 200 liters / second with the same operational and maintenance costs as in previous years. The first scheme in this study assumed that the capital is entirely sourced from the capital of PDAM of Sidoarjo Regency itself. So the cash expenses incurred to meet the costs that appear in the table 5 cash out as follows;

NO	DESCRIPTION	AMOUNT (Rp)
1	Capital year 0	200,000,000,000
2	Buy 100 liter / second bulk water (3,110,400 m3) in year 1	7,776,000,000
3	Operational and maintenance costs for the 1st year and beyond	811,600,000
4	Buy bulk water 100 liters / sec (3,110,400 m3) in year 2 and beyond	15,552,000,000

Tabel 5. Cash Out

For new cash comes in the year 1 and continously. In the 1st year there is a non-water reception along with a new subscriber process. Continuing with the new installation by the customer then start the customers consume clean water from the system offtake Temple so that appear revenue of water. However, the use of clean water in the 1st year has not been as much in the 2nd year and beyond due to the different water quotas. So the revenue of water income is also different for the 1st year while the 2nd year onwards the amount of water revenues is assumed to be equal to the assumption of the amount of buffer and the fixed consumption in the same amount of water quota. This can be shown by the table 6 cash entry as follows;

NO	DESCPTION	AMOUNT (Rp)
1	Non-water reception year 1	37,115,770,000
2	Water sales year 1	27,173,616,000
3	Water sales year 2nd and continously	42,363,648,000

Tabel 6. Cash In

E. Net Cash Flow

From cash out and cash came in net cash flow as the difference between cash out and cash in. flow Net cash is calculated since the 0th year commencement of investment until subsequent years until the end of investment. This can be shown by Net Cash Flow table 7 as follows;

NO	YEAR	CASH OUT (Rp)	CASH IN (Rp)	NET CASH FLOW (Rp)
1	Year-0	200,000,000,000	-	(200,000,000,000)
2	Year-1	8,587,600,000	64,289,386,000	55,701,786,000
3	Year-2	16,363,600,000	42,363,648,000	26,000,048,000
4	Year-3	16,363,600,000	42,363,648,000	26,000,048,000
5	Year-4	16,363,600,000	42,363,648,000	26,000,048,000
6	Year-5	16,363,600,000	42,363,648,000	26,000,048,000
7	Year-6	16,363,600,000	42,363,648,000	26,000,048,000
8	Year-7	16,363,600,000	42,363,648,000	26,000,048,000
9	Year-8	16,363,600,000	42,363,648,000	26,000,048,000
10	Year-9	16,363,600,000	42,363,648,000	26,000,048,000
11	Year-10	16,363,600,000	42,363,648,000	26,000,048,000
12	Year-11	16,363,600,000	42,363,648,000	26,000,048,000
13	Year-12	16,363,600,000	42,363,648,000	26,000,048,000
14	Year-13	16,363,600,000	42,363,648,000	26,000,048,000
15	Year-14	16,363,600,000	42,363,648,000	26,000,048,000
16	Year-15	16,363,600,000	42,363,648,000	26,000,048,000
17	Year-16	16,363,600,000	42,363,648,000	26,000,048,000
18	Year-17	16,363,600,000	42,363,648,000	26,000,048,000
19	Year-18	16,363,600,000	42,363,648,000	26,000,048,000
20	Year-19	16,363,600,000	42,363,648,000	26,000,048,000
21	Year-20	16,363,600,000	42,363,648,000	26,000,048,000
22	Year-21	16,363,600,000	42,363,648,000	26,000,048,000
23	Year-22	16,363,600,000	42,363,648,000	26,000,048,000
24	Year-23	16,363,600,000	42,363,648,000	26,000,048,000
25	Year-24	16,363,600,000	42,363,648,000	26,000,048,000
26	Year-25	16,363,600,000	42,363,648,000	26,000,048,000

Tabel 7. Net Cash Flow

ISSN No:-2456-2165

F. DCF (Discounted Cash Flow)

Discounted cash flow is obtained by discounting future value (future) to present value. From cash flow (net cash flow) an approximate (present value) present value for the Offtake Candi project in the DCF table 8 as follows;

NO	YEAR	*NET CASH FLOW* (Rp)	*DISCOUNT FACTOR*	*PRESENT VALUE* (Rp)
1	Year-0	(200,000,000,000)	1	(200,000,000,000)
2	Year-1	55,701,786,000	1.1	50,637,987,273
3	Year-2	26,000,048,000	1.21	21,487,642,975
4	Year-3	26,000,048,000	1.331	19,534,220,887
5	Year-4	26,000,048,000	1.4641	17,758,382,624
6	Year-5	26,000,048,000	1.61051	16,143,984,204
7	Year-6	26,000,048,000	1.771561	14,676,349,276
8	Year-7	26,000,048,000	1.9487171	13,342,135,706
9	Year-8	26,000,048,000	2.14358881	12,129,214,278
10	Year-9	26,000,048,000	2.357947691	11,026,558,434
11	Year-10	26,000,048,000	2.59374246	10,024,144,031
12	Year-11	26,000,048,000	2.853116706	9,112,858,210
13	Year-12	26,000,048,000	3.138428377	8,284,416,555
14	Year-13	26,000,048,000	3.452271214	7,531,287,777
15	Year-14	26,000,048,000	3.797498336	6,846,625,252
16	Year-15	26,000,048,000	4.177248169	6,224,204,774
17	Year-16	26,000,048,000	4.594972986	5,658,367,977
18	Year-17	26,000,048,000	5.054470285	5,143,970,888
19	Year-18	26,000,048,000	5.559917313	4,676,337,171
20	Year-19	26,000,048,000	6.115909045	4,251,215,610
21	Year-20	26,000,048,000	6.727499949	3,864,741,464
22	Year-21	26,000,048,000	7.400249944	3,513,401,330
23	Year-22	26,000,048,000	8.140274939	3,194,001,210
24	Year-23	26,000,048,000	8.954302433	2,903,637,463
25	Year-24	26,000,048,000	9.849732676	2,639,670,421
26	Year-25	26,000,048,000	10.83470594	2,399,700,383

Tabel 8. Discounted Cash Flow (DCF)

G. NPV (Net Present Value)

Net Present Value (NPV) is obtained by calculating the total Present Value generated from Discounted Cash Flow. From the previous DCF table obtained Net Present Value (NPV) as in table 9 as follows;

NO	YEAR	*PRESENT VALUE* (Rp)
1	Year-0	(200,000,000,000)
2	Year-1	50,637,987,273
3	Year-2	21,487,642,975
4	Year-3	19,534,220,887
5	Year-4	17,758,382,624
6	Year-5	16,143,984,204
7	Year-6	14,676,349,276
8	Year-7	13,342,135,706
9	Year-8	12,129,214,278
10	Year-9	11,026,558,434
11	Year-10	10,024,144,031
12	Year-11	9,112,858,210
13	Year-12	8,284,416,555
14	Year-13	7,531,287,777
15	Year-14	6,846,625,252
16	Year-15	6,224,204,774
17	Year-16	5,658,367,977
18	Year-17	5,143,970,888
19	Year-18	4,676,337,171
20	Year-19	4,251,215,610
21	Year-20	3,864,741,464
22	Year-21	3,513,401,330
23	Year-22	3,194,001,210
24	Year-23	2,903,637,463
25	Year-24	2,639,670,421
26	Year-25	2,399,700,383
NPV		**63,005,056,172**

Tabel 9. Net Present Value (NPV)

From table 10. obtained positive NPV 63.005.056.172. This analysis shows that the offtake Candi project is feasible to run because the expected rate of return exceeds the discount rate.

H. IRR (Internal Rate of Return)

IRR is obtained from Net Cash Flow as follows;

NO	YEAR	*NET CASH FLOW* (Rp)
1	Year-0	(200,000,000,000)
2	Year-1	55,701,786,000
3	Year-2	26,000,048,000
4	Year-3	26,000,048,000
5	Year-4	26,000,048,000
6	Year-5	26,000,048,000
7	Year-6	26,000,048,000
8	Year-7	26,000,048,000
9	Year-8	26,000,048,000
10	Year-9	26,000,048,000
11	Year-10	26,000,048,000
12	Year-11	26,000,048,000
13	Year-12	26,000,048,000
14	Year-13	26,000,048,000
15	Year-14	26,000,048,000
16	Year-15	26,000,048,000
17	Year-16	26,000,048,000
18	Year-17	26,000,048,000
19	Year-18	26,000,048,000
20	Year-19	26,000,048,000
21	Year-20	26,000,048,000
22	Year-21	26,000,048,000
23	Year-22	26,000,048,000
24	Year-23	26,000,048,000
25	Year-24	26,000,048,000
26	Year-25	26,000,048,000
IRR		**14.42%**

Tabel 10. Internal Rate of return (IRR)

ISSN No:-2456-2165

From the analysis obtained IRR value of 14.42%. Greater than expected MARR of 10% So the Offtake Candi project is feasible to work on.

I. Capital and loans

The initial alternative is assumed that the capital is fully obtained from the financial capability of the Sidoarjo district's own PDAM and without borrowing. But in reality the PDAM's ability can not give 100% Capital to this SPAM project. This raises the need for loans due to the PDAM's ability to reach the total cost of the offtake Candi project. The loan is in the form of external loan in the form of soft loan or interest rate loan. The composition of capital and loans are shown in Table 11 as follows;

No	Total Investment	PDAM Capital		Loan	
	(Rp)	(%)	(Rp)	(%)	(Rp)
1	200,000,000,000	100	200,000,000,000	-	-
2	200,000,000,000	50	100,000,000,000	50	100,000,000,000
3	200,000,000,000	40	80,000,000,000	60	120,000,000,000
4	200,000,000,000	30	60,000,000,000	70	140,000,000,000

Tabel 11. Composition of Capital and Loans

From the table of composition of capital and loans above looks the first alternative assumed the capital trap of PDAM to investment cost is 100% so no loan is needed. The second alternative is assumed that PDAM's capital capability can only finance with 50% capital from investment cost, the difference is that 50% is done by loan. The third alternative to PDAM's capital capability is only 40% while the difference is 60% done by loan. The fourth alternative to PDAM's ability is only 30% while the difference is 70% done by loan. This alternative is needed because of the ability of PDAM Sidoarjo with limited budget. So that the required loan to the bank or other than the capital of the PDAM itself.

J. Sensitivity Analysis

To measure the sensitivity of the feasibility limit of the investment project offtake temple from the results of further analysis required sensitivity analysis of a variable value that influences in case of changes or errors. Factors to be tested for the level of sensitivity, among others;

- Increase in Cost value
- Decrease in income
- Increase in loan interest rates

The sensitivity analysis of investment value increase is done to find out if there is an increase of investment in project implementation hence can be estimated until what is the limit of investment that still acceptable. At the time of trial conducted NPV calculations found limit of investment increase if fully capital of PDAM hence acceptable investment limitation is reaching Rp 263.005.056.000, - then NPV still positive 172. But when investment rise to Rp 263.005.056.500, - found negative NPV change 328.

A sensitivity analysis of income reduction is done to find out if a decrease in income post project implementation can be predicted to what the acceptable income degradation limit is. The NPV calculation on the total capital composition by the PDAM was found if the income in the 2nd year decreased to Rp 34.649.954.500, per year then the NPV was still positive 220, but when the decrease reached Rp 34.649.954.400, the year was found a negative NPV change 596 .

The sensitivity analysis of loan interest rate increase is done to find out if the capital and loan composition increase the loan interest rate during the investment period until what is the limit of the interest rate hike that is still acceptable. Conducted trials on the composition of capital and loans 30% and 70%, if the loan interest rate increased up to 19% generated NPV is still positive 4.744.556.493 and IRR = 10.50%. But when the interest rate rose to 20% then found the NPV to negative 2.181.615.855 and IRR = 9.78%.

V. CONCLUSION

Based on the results of the discussion and experiment in this study it can be concluded that investment project offtake Candi of Umbulan Drinking Water System feasible to do with attention to investment costs 200 billion rupiah and MARR 10% generated positive NPV 63.005.056.172 and IRR 14.42% . Positive project investment is greater if done with PDAM capital composition and loans of 30% and 70% resulting in NPV level 80,526,319,393 and IRR of 23.33%. The loan is made with 7% interest rate and 10 years time

REFFERENCES

[1]. Brueggeman, W. B. and Fisher, J. D. (2011). Real Estate Finance and Investments Fourteenth Edition. New York: McGraw - Hill.
[2]. Farley, M., et al. (2008). The Manager’s Non-Revenue Water Hanbook:
[3]. A Guide to Understanding Water Losses. Bangkok 10330 : USAID
[4]. Miles, M. E., Netherton, L.M. and Schmitz, A. (2015). Real Estate Development : Principles and Process Fifth Edition. Washington, D. C.: Urband Land Institute.